The Electrical Industry's Weekly Magazine

December 16, 1957

Electrical World

Price 50 Cents

A McGraw-Hill Publication

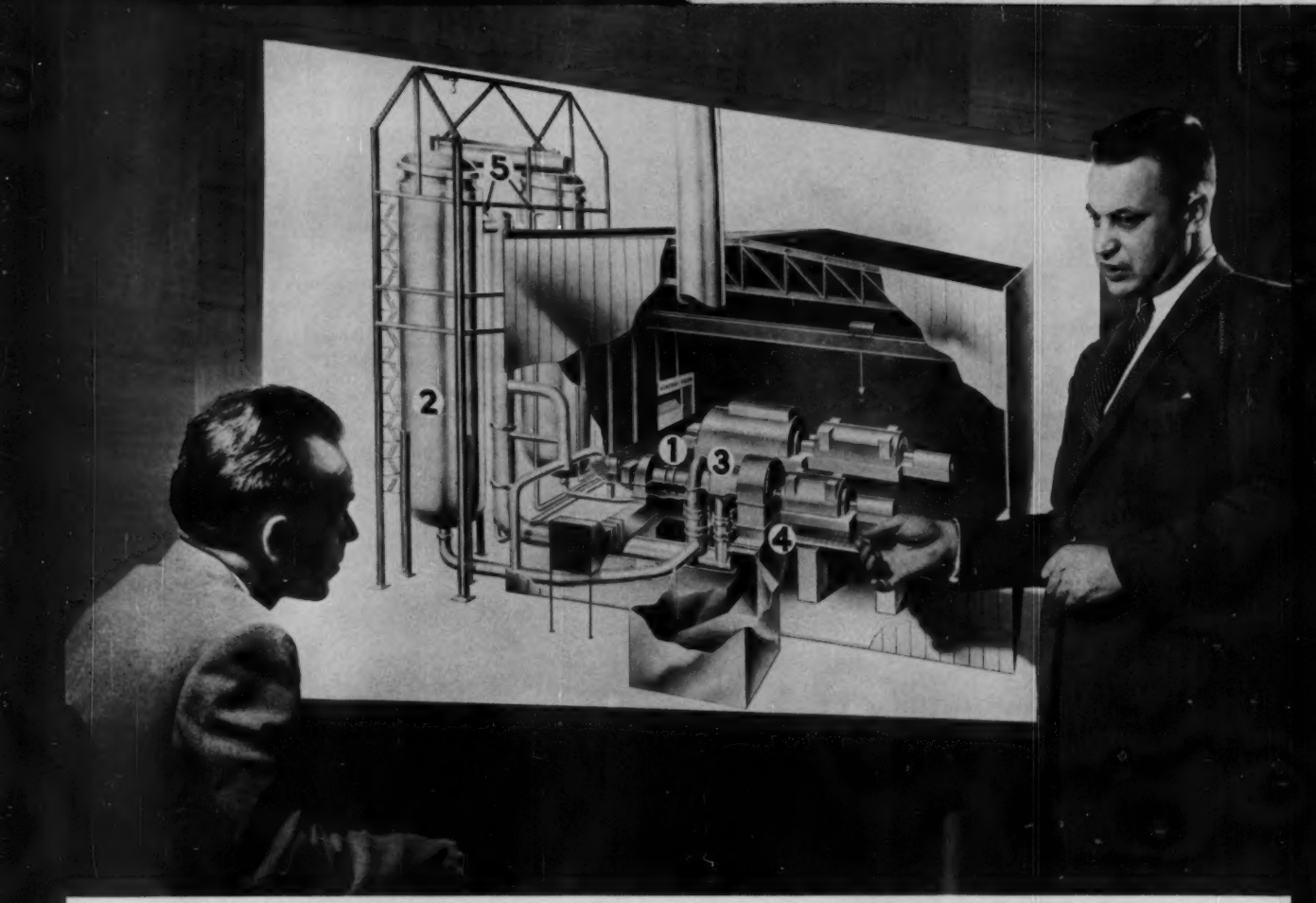
2nd EW Electric Space Heating Survey Shows:

The Curve is Up in All Markets

...Page 95

Set Promotional Rates to Sell . . . page 84

E B POWER
UNIVERSITY MICROFILMS IN
313 N 1 ST
ANN ARBOR MICH



COMBINED GAS-STEAM CYCLE begins as air enters compressor (1) and is discharged to boiler (2). From boiler, gas enters gas turbine (3), and exhausts (4) to economizer, stack gas cooler, and stack. Steam at (5) goes to steam turbine. The supercharged boiler design shown in the illustration above appears through courtesy of Foster Wheeler Corporation. Discussing economies of new combined-cycle power plant are General Electric's W. D. Marsh (left), Engineering Planning & Development Section, and H. A. Carlson, Gas Turbine Department.

General Electric announces 133,500 kw combined gas-steam cycle power plant

These benefits are expected:

- **6% lower heat rate**
- **reduced boiler weight and volume**
- **low plant investment**
- **faster plant start-up**

The combined gas-steam cycle power plant offers promise of major heat rate gains. In this respect, the combined-cycle plant is one of the most significant developments in the electric power generation field since the General Electric Company installed the first steam turbine-generator unit using the modern reheat cycle in 1950.

General Electric turbine engineers expect net station heat rate for this gas-fired, combined gas-steam cycle to be 9,413 Btu/kw-hr—with little or no increase in plant investment. This rate compares with 10,045 Btu/kw-hr for a conventional steam cycle using a similarly rated, tandem-compound, double flow unit of the same steam conditions.

Looking still further into the future, General Electric engineers expect operating experience with a gas-fired plant to help speed the adaption of the combined cycle to oil- and coal-fired plants. For more information on how your utility can achieve lower cost generation by applying this new plant, contact your General Electric Apparatus Sales Office, or request bulletin GER-1452 from General Electric, Section 301-372, Schenectady 5, N. Y.

LIVE BETTER ELECTRICALLY

MORE POWER TO AMERICA

GENERAL ELECTRIC

Electrical World

Vol. 148, No. 25 December 16, 1957

Published for 83 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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Interest grows in pros and cons of inducement rates that provide tougher competition, better load factors.....p 84

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INDUSTRIAL

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Electric Space Heating 1957
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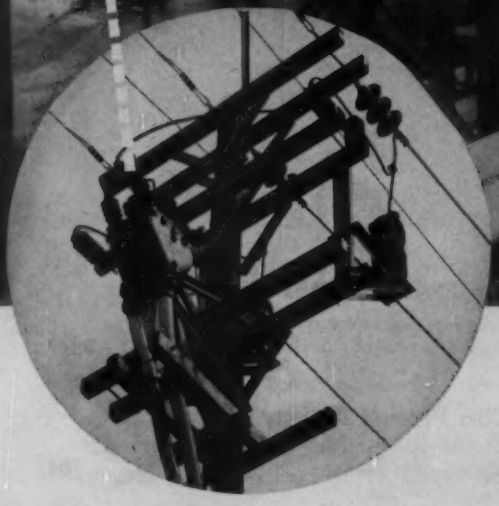

new 15kv Loxarmor* circuits eliminate conduit, allow simple terminations

Stainless steel Loxarmor cable was recently chosen by the Petro-Tex Chemical Corporation, jointly owned by Tennessee Gas Transmission Co. and Food Machinery and Chemical Corp., for main feeder circuits in their Houston, Texas plant.

Heart of this system is Okolite insulation applied by Okonite's strip-insulating method. The advantages inherent in the Loxarmor construction add considerably to the basic advantages of the Okolite insulation.

Advantages of Loxarmor construction:

. . . stainless steel armor provides the ultimate resistance to corrosive atmospheres prevalent in petrochemical plants.

. . . reduces installation and maintenance costs because of flexibility and the elimination of rigid conduit. Open type construction permits quick, simple inspection of your electrical system.

. . . completely salvageable—can be reused at will or can be easily re-routed.

. . . standard fittings permit relatively simple terminating procedures.

Petro-Tex Chemical Corporation's use of this construction typifies the modern trend to Loxarmor. Where the maximum security of a rigid conduit is not necessary, Loxarmor is a highly acceptable alternate.

Bulletin EW-1090 provides a thorough description of Loxarmor, providing engineering information, splicing and terminating drawings and instructions, and a discussion of the various components. Loxarmor power and control cables are available with any of Okonite's strip-insulated and extruded rubber insulations or with varnished cambric and plastic dielectrics. Write for it today to The Okonite Company, Passaic, N. J.

***Okonite's trade name for interlocked S-shaped armor—available in stainless or galvanized steel, aluminum or bronze. Protective coverings can be applied over the armor for special corrosion and chemical resistance.**

4710

where there's electrical power . . . there's **OKONITE CABLE**

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. . . from the publisher

Thus Saith the Editors:

"We know in part, and we prophesy in part."
–I Corinthians XIII. 9.

Two weeks from now the editors of Electrical World will be back with their annual predictions of what's in store for the industry next year.

Like Paul in the Bible, we try to combine well-grounded knowledge with educated guesswork. So far the formula has worked pretty well. For instance, last year we had this to say about 1957:

- "More rate increases forthcoming . . ."
- "'New money' financing will be higher despite higher interest costs."
- "Federal Atomic Insurance will become law."
- "More utility groups will be formed to develop nuclear power plants."

Naturally, we can mis-fire at times, too. This year's appliance market and the demand for steel both had us fooled. Neither measured up to expectations.

The year '58 will be full of even more surprises — the question marks bigger than ever. And industry should face its toughest decisions yet. What some of these decisions will be, and the events that will bring them to bear, will be examined in this year's Year-End Issue. It'll be coming your way Dec. 30.

Fischer Black

ELECTRICAL WORLD

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17 years with American Gas and Electric

from Twin Branch in '40...

Twin Branch, Indiana & Michigan Electric Company (Completed 1940)

Philo Plant, Ohio Power Company (Completed 1957)

...to Philo in '57

Grinnell has supplied pipe hangers for the following plants of American Gas and Electric System:

Utility	Station	Unit No.	Completion Date
Indiana & Michigan	Twin Branch	3	1940-41
Appalachian Electric	Cabin Creek	8, 9	1942-43
Ohio Power	Philo	4, 5	1941-42
Indiana & Michigan	Twin Branch	4	1944
Ohio Power	Tidd	1, 2	1945-48
Appalachian Electric	Philip Sporn	1	1950
Ohio Power	Philip Sporn	2	1950
Appalachian Electric	Kanawha River	1, 2	1953
Ohio Power	Muskingum River	3, 4	1957
Appalachian Electric	Glen Lyn	6	1957
Ohio Power	Philo	6	1957
Ohio Power	Kammer	1, 2, 3	1958
Appalachian Electric	Clinch River	1, 2	1958

Grinnell Pipe Hangers have met the challenge of skyrocketing pressures and climbing temperatures

Back in 1940, American Gas and Electric Company System made industry history when Unit #3 at the Twin Branch plant of Indiana & Michigan Electric Company went on the line at 2300 psi and 940 F. Grinnell designed the pipe suspension system and supplied the pipe hangers for this pace-setting unit.

In the years that followed, as other AGE stations and units were built, Grinnell continued to serve this progressive utility company. When the supercritical Philo plant of Ohio Power Company was conceived, Grinnell again was selected to engineer the pipe suspension system. Working in an uncharted area of supercritical pressures, Grinnell engineered a system to provide the required safety, and furnished all of the pipe hangers and supports for this 4500 psi — 1150 F steam unit.

Grinnell invites *your* problems in pipe suspension. Remember, you benefit from more than a century of piping specialization when you call on Grinnell.

GRINNELL

AMERICA'S #1 SUPPLIER OF PIPE HANGERS AND SUPPORTS

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems

Call your nearest Graybar office for these three helps on pole-line construction:

1. Fast, accurate catalog information and quotation service on over 100,000 electrical items.
2. Stocks of tools and utility standard items for scheduled delivery including pre-fabricated transmission structure assemblies.
3. Assistance in planning through Graybar Outside Construction Specialists.

When home building means line building

Put Graybar on your construction staff

As residential areas spread outward from towns and cities and your load demands build up, call on Graybar for maximum help. A telephone call to your nearest Graybar warehouse or office puts our staff to work for you. Whether you're building new lines, adding more feeders or increasing feeder size, Graybar can supply the materials, equipment and supplies you'll need. In emergencies, or for regularly-scheduled shipments, count on prompt deliveries of anything and everything you need for pole-line maintenance and construction . . . via Graybar. 712-912

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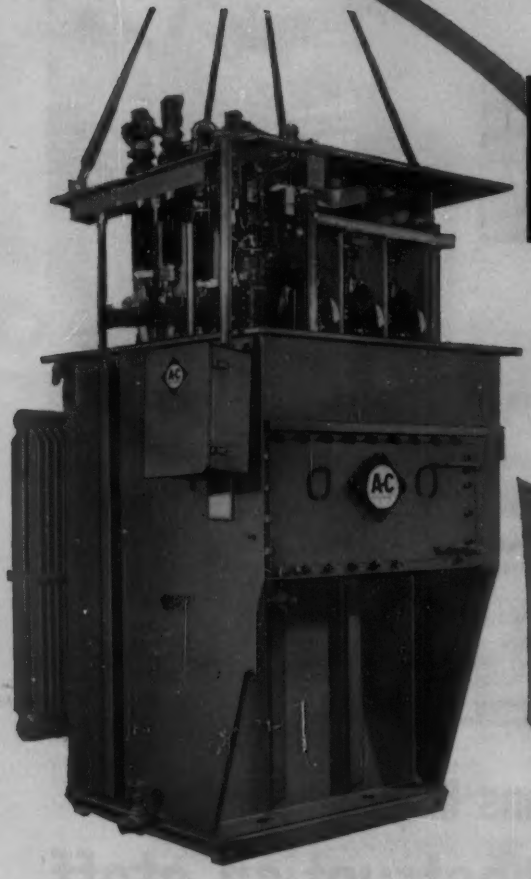
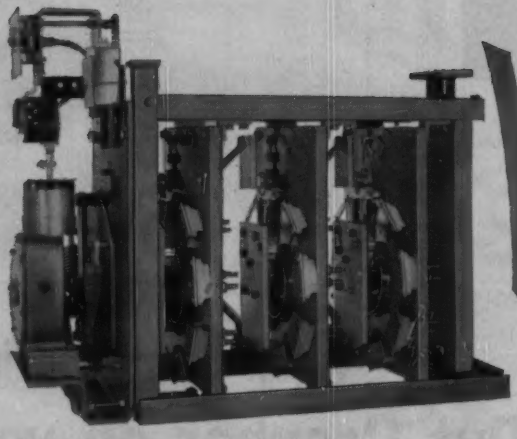
reasons for service

Allis-Chalmers





unit construction

— makes untanking easy . . . assures good workmanship.

In this construction, transformer and tap-changing mechanism are mounted to cover. All connections are made while unit is accessible, before it is tanked. Continuous leads from transformer coils to dial switch add reliability by eliminating 78 electrical connections.

simple mechanism

Many gears and cams are eliminated to reduce moving parts to a minimum. Simple, condenser-type motor has no commutator, slip rings, brushes or centrifugal switch. Driving motor and moving parts never require lubrication or adjustment because they are completely immersed in oil. Taps changed with fast snap action — without shock — without brakes or sealing-in switches.

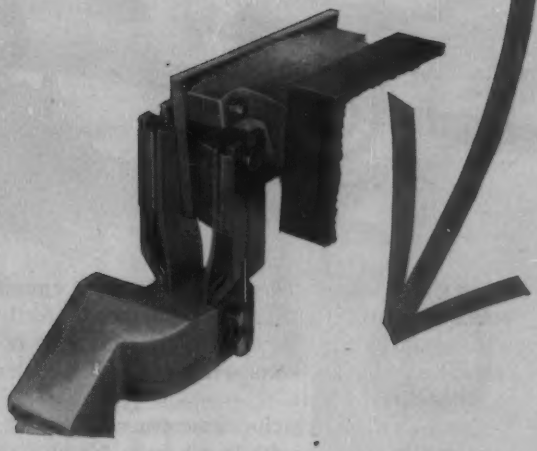
These are only a few of the many outstanding features that account for the remarkable record of A-C 3-phase regulators. For complete specifications, call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

A-C ALLIS-CHALMERS

A-5472

remarkable of

3-phase regulators



longest contact life

Sturdy double-contact construction with backing springs assures high contact pressure. This arrangement prolongs life of contacts by minimizing blowback from severe short circuits . . . reducing contact bounce . . . cutting arcing time. Large contacts, which increase thermal capacity, are made of sintered RS-1045 for high resistance to pitting and burning.

"feather-touch" control

Fully automatic control, with sensitive response to voltage deviation, keeps voltage within band settings. Simple design makes all parts accessible for easy inspection and adjustment. Electrically interlocked motor switches permit only one circuit to close at a time. Stabilizing coil incorporated into solenoid of voltage-regulating relay.

ALLIS-CHALMERS

Pennsylvania Transformer Introduces *the*

- **FASTER INTERRUPTING TIME**
  Recloser completely clears the line in just 2½ cycles —or twice as fast as the equivalent oil circuit breaker.
- **SAVES UP TO 25% IN COSTS**
  Pennsylvania Suburbanite Substation offers savings as high as 30% in initial costs, compared with other types of substations.
- **EASY TO INSTALL**
  Integral construction simplifies installation . . . keeps costs down.
- **FLEXIBLE IN DESIGN**
  May be supplied with either one or two circuits . . . and with LTC, metering equipment and fuses to meet individual requirements.
- **RECOMMENDED FOR SUBSTATIONS THROUGH 2500 KVA**

Pennsylvania's "Suburbanite" substation was designed specifically for less populated areas in which load conditions are such that relatively little capacity is required and economy is a major factor in the choice of substation equipment.

The Suburbanite provides the desired economy without sacrificing necessary efficiency and safety. It is a compact, easy-to-install substation that utilizes a recloser rather than an air or oil circuit breaker. Mounted in framework attached directly to the transformer, the completely automatic recloser clears the low voltage line in just 2½ cycles in the event of a fault.

Other equipment includes metering devices . . . load tap changing in the low voltage for plus or minus 10% regulation in 32 steps . . . high and low voltage lightning arresters . . . and high voltage fuses. High voltage lines can be brought directly from the customer's cutout switch (mounted on a nearby pole) to a dead-ending structure on the h.v. side of the transformer.

The Suburbanite saves as much as 25% in initial cost, compared with other types of substations. In many cases, savings also result from the simplicity and ease of installation, which requires a minimum of additional steel work.

The Suburbanite is available with either one or two circuits . . . and can be tailor-designed to fit individual requirements regarding fuses, metering, and load tap changing. For information regarding a specific application, contact Pennsylvania Transformer Division, McGraw-Edison Company, Canonsburg, Pa.

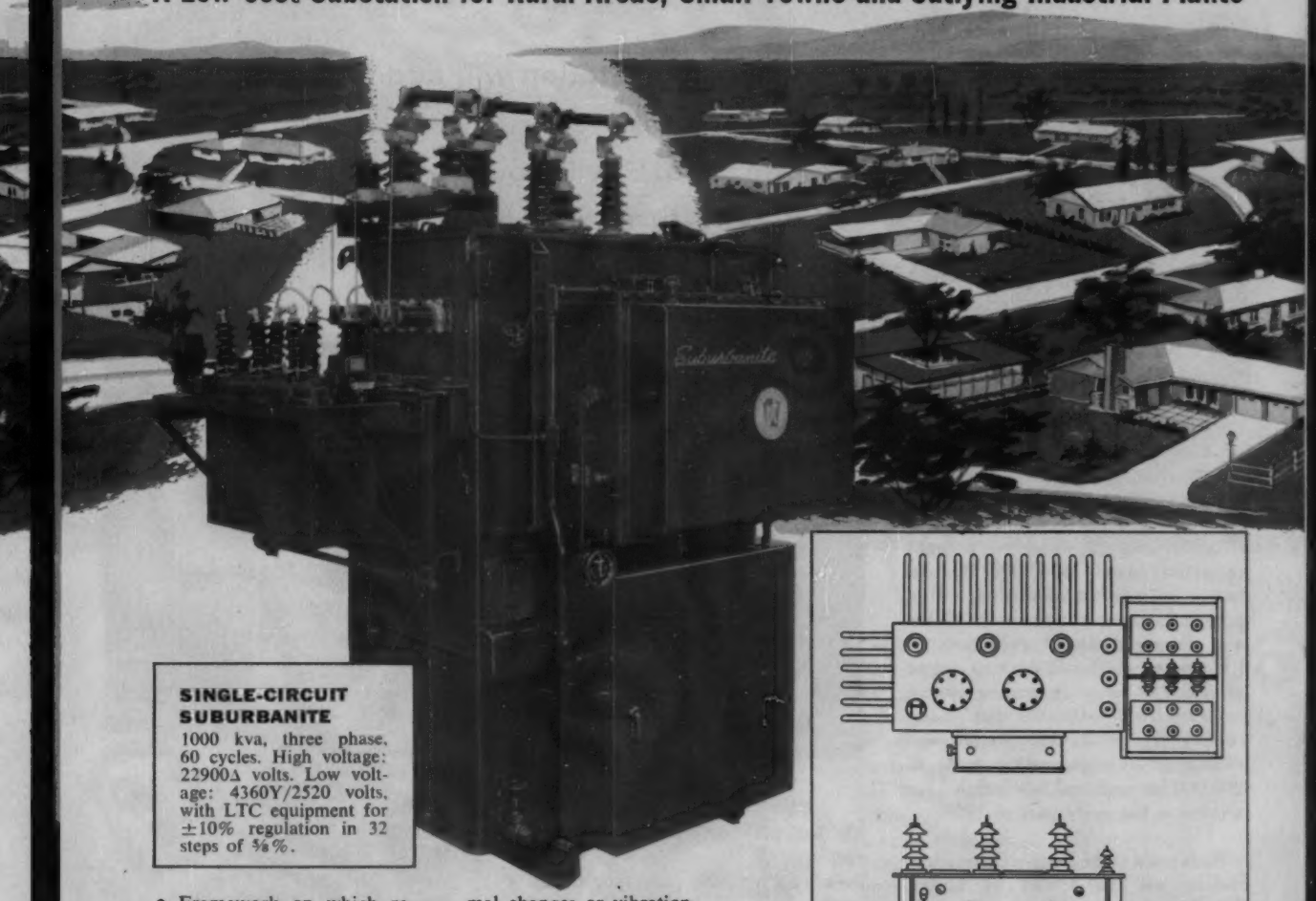
PENNSYLVANIA TRANSFORMERS pt

McGRAW EDISON

PENNSYLVANIA POWER

"Suburbanite"

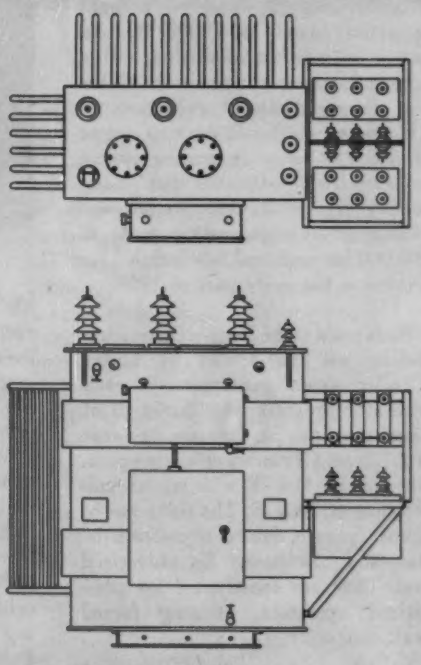
A Low-cost Substation for Rural Areas, Small Towns and Outlying Industrial Plants



SINGLE-CIRCUIT SUBURBANITE

1000 kva, three phase, 60 cycles. High voltage: 22900Δ volts. Low voltage: 4360Y/2520 volts, with LTC equipment for ±10% regulation in 32 steps of ⅝%.

- Framework on which recloser is mounted is attached directly to transformer. Shipped completely assembled.
- Built-in winch simplifies inspection and maintenance of recloser. Bottom section of recloser tank, with oil, can be lowered—while top section, with contacts exposed, remains bolted to framework.
- Flexible connectors between transformer l.v. bushings prevent strain from thermal changes or vibration.
- Hood of LTC compartment is hinged for easy access.
- Metering equipment is located in easy-to-reach cabinet.
- Sealed transformer tank is reinforced to protect against positive and negative operating pressures.
- Built-in dead-ending structure (not visible in photo) is provided on h.v. side.
- High voltage bushings equipped with fuses.



DUPLEX (Double-Circuit) SUBURBANITE

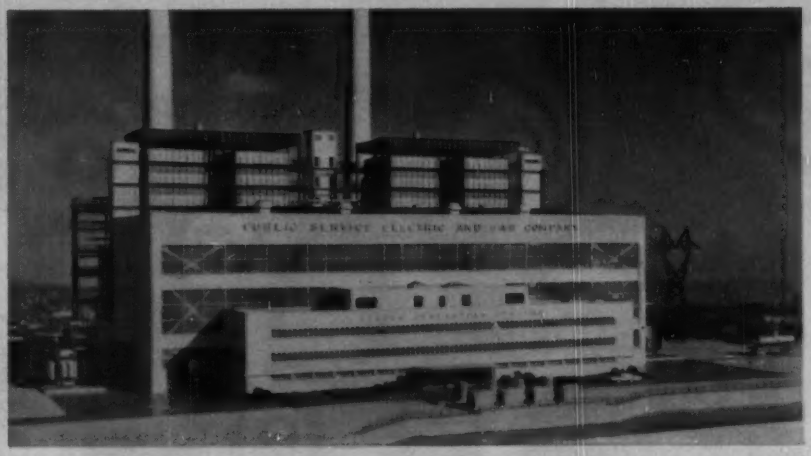
Includes two automatic reclosers mounted in frames attached to the l.v. side of the transformer. A fault in one l.v. circuit does not affect the other one.

TRANSFORMERS

Kw Capacity GOING UP

for PUBLIC SERVICE ELECTRIC AND GAS COMPANY

New Bergen Generating Station will add 580,000 kw to The Public Service system— and Units No. 1 and No. 2 will both be served by FW double-furnace reheat steam generators of 1,900,000 lb/hr capacity

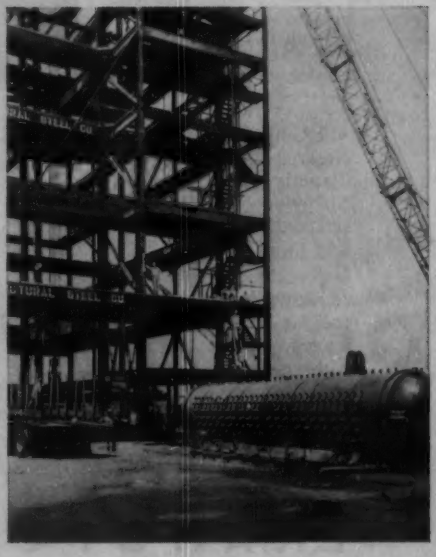


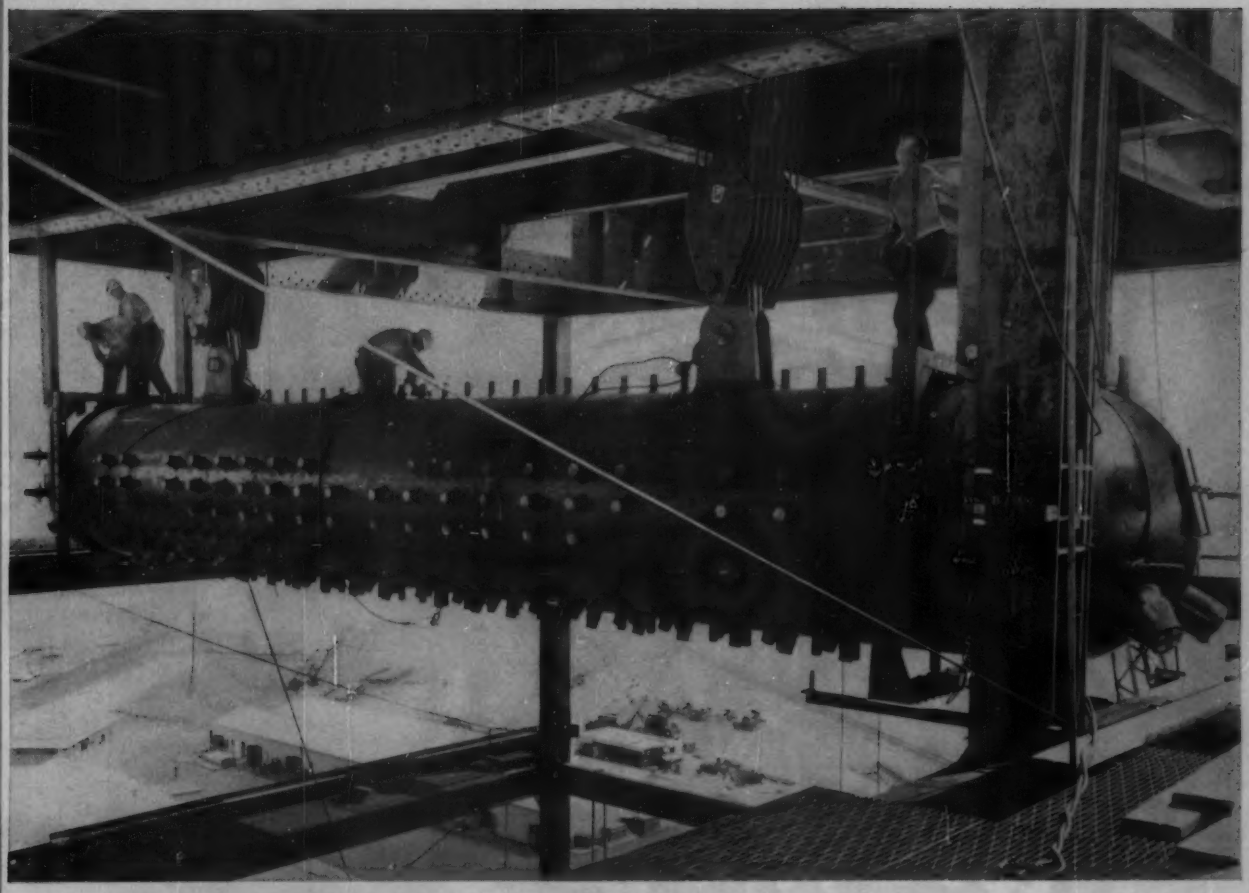
THE GREAT postwar growth of New Jersey's industry and suburbs has placed heavy demands upon the power capacity of Public Service Electric and Gas Company. To keep ahead of this rapidly growing demand, Public Service has embarked upon a construction program which will amount to approximately $345,000,000. An important segment of this expansion program is the construction of the new Bergen Generating Station, in Ridgefield, which will have an output of 580,000 kw — increasing system capacity by 27½% over that of December 31, 1956. The station will consist of two generating units of 290,000 kw each and is scheduled for service in the early part of 1959.

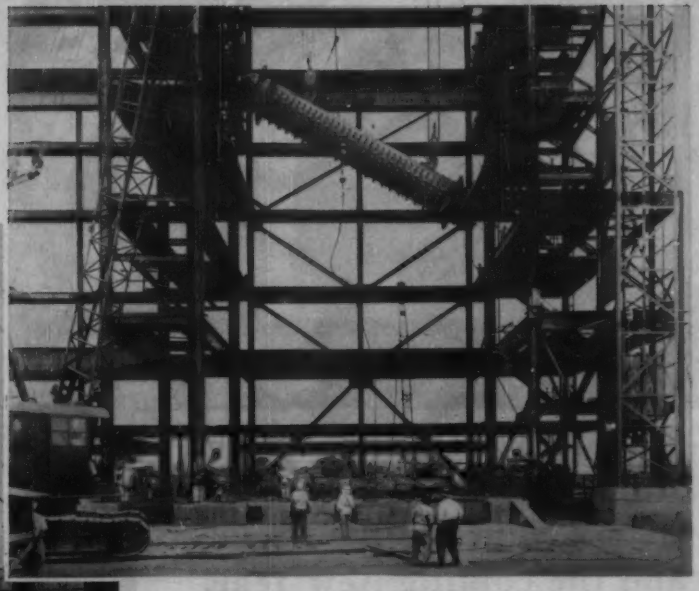
Both units at the Bergen Generating Station will be served by Foster Wheeler steam generators — each generator providing 1,900,000 lb of steam per hour at a design pressure of 2,725 psig. Primary steam temperature will be 1100 F with reheat temperature of 1050 F. The units are of double-furnace, natural circulation design and are fueled by pulverized coal. They are constructed for pressurized operation, utilizing forced draft fans only.

In addition to the steam generators Public Service has also ordered six FW ball mill pulverizers — three for each unit. With capacities of 81,000 lbs of coal per hour each, they are the largest ball mills manufactured by FW to date.

With more than a half-century of experience in steam generation — and the finest modern manufacturing facilities in three large plants—Foster Wheeler welcomes the opportunity to quote on your requirements. You'll receive the same kind of heat engineering experience and service that led Public Service Electric and Gas Company to award Foster Wheeler its part of the Bergen Generating Station.







The photographs at left and above show three stages in the process of hoisting the 125-ton steam drum into erected position in the FW steam generator for Unit No. 1 at the Bergen Generating Station of Public Service Electric and Gas Company. The generator will supply 1,900,000 lb of steam per hour at 2,725 lb/sq in gage design, 1100 F primary steam temperature and 1050 F reheat temperature.

Both of the units at Bergen are expected to go into service early in 1959.

FOSTER WHEELER

NEW YORK • LONDON • PARIS • ST. CATHARINES, ONT.

HOLIDAY GREETINGS
Merry Xmas
Merry Xmas!
Happy New Year
Happy New Year
Merry Xmas!
—sincere wishes for Health, Happiness and Prosperity through the Holiday Season and the coming New Year.
PP INC.
Porcelain Products, Inc.
High Voltage Division
Parkersburg, W. Va.

FULL MEASURE FOR YOUR METER DOLLAR

Westinghouse class 200 "Lifetime" meter... another Westinghouse first

Present meters are doing a creditable job . . . but the load is getting too great. Surveys show that meters installed today will be outmoded in 15 years. Westinghouse, in an effort to offer you "Full Measure" for your meter dollar, developed the class 200 "Lifetime" meter which is capable of carrying any single-phase load in the foreseeable future.

"Full Measure" takes on its greatest significance when you consider: 1.) Class 200 "Lifetime" meters have been available for over a year at the *same price* you have been paying for Class 100 meters; 2.) they are guaranteed for a full *30 years*; 3.) where lightning is prevalent, the savings are *even greater* because the "Lifetime" meter has its own arrester which expels the arc outside the meter, where it can do no damage to meter or customer property.

We invite you to inquire further about getting the "Full Measure" for your meter dollar. Contact your local Westinghouse Sales Representative or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-40501

YOU CAN BE SURE... IF IT'S

Westinghouse

Commonwealth Edison orders another

C-E CONTROLLED CIRCULATION BOILER

. . . its 6th in past 5 years

Since January, 1953, when Commonwealth Edison ordered a 220,000-kw C-E Controlled Circulation Boiler for its State Line Station, this utility has placed orders for five additional units of the controlled circulation type. The unit just ordered, which will be installed in the Crawford Station, will serve a 325,000-kw turbine generator with steam conditions of 2100 psi (superheater outlet), 1055 F primary steam temperature and 1005 F reheat temperature. Two similar controlled circulation units are now in process of installation, one at Waukegan Station, and one at Fisk Station. A 275,000-kw unit was placed in service in June of this year at the Will County Station, and a 220,000-kw unit is being installed at Crawford. These six units bring the total capacity of C-E Controlled Circulation Boilers for Commonwealth Edison Stations to 1,690,000 kilowatts.

Thus the trend to controlled circulation continues apace. This trend is, in fact, the *big boiler* story of this decade. Since 1950, leading utilities in this country and abroad have placed orders totaling approximately $500,000,000 and representing an aggregate capacity in excess of 20,000,000 kilowatts. Moreover, 65 per cent of all purchasers have placed repeat orders, averaging better than three contracts per company. Such large-scale acceptance of a new boiler design in so short a time is unique in the annals of power history.

STATE LINE STATION

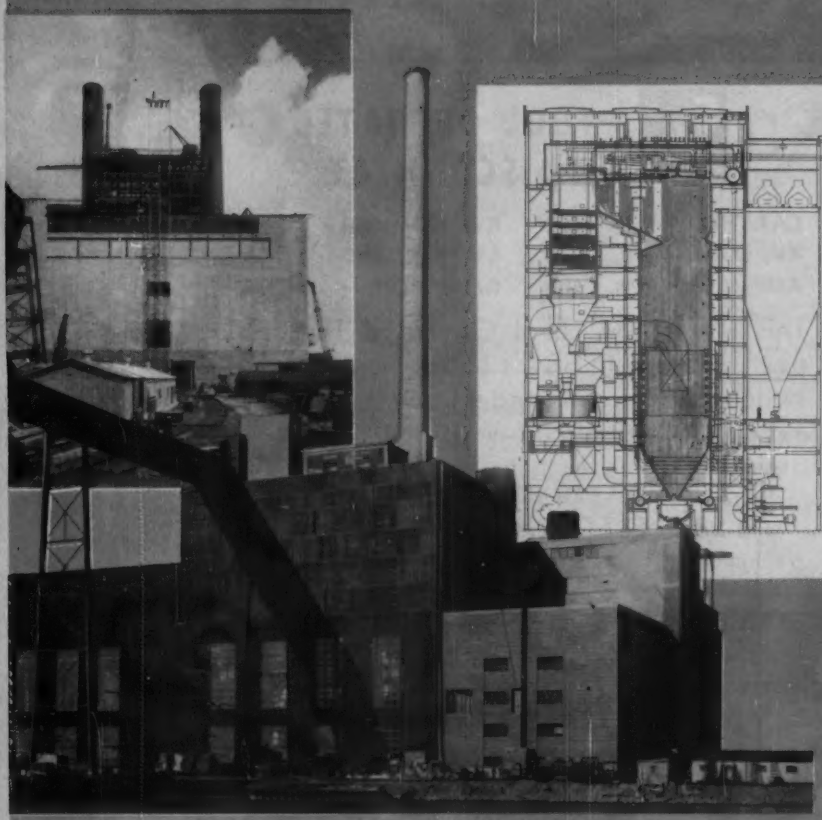
COMBUSTION ENGINEERING

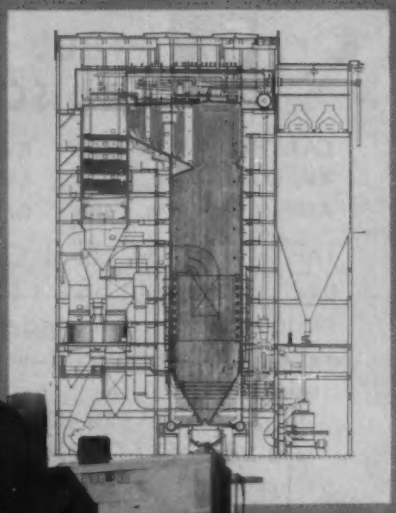
C-140

Combustion Engineering Building
200 Madison Avenue, New York 16, N. Y.

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT; NUCLEAR REACTORS;

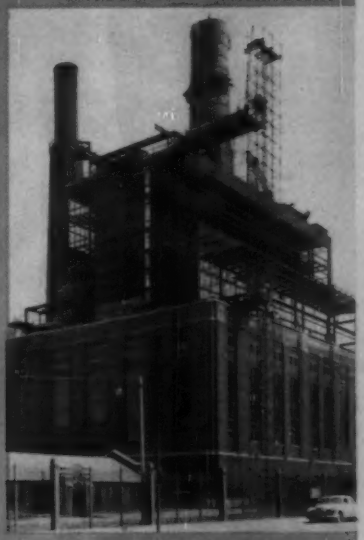
These Commonwealth Edison Stations have C-E Controlled Circulation Boilers in Service or on Order



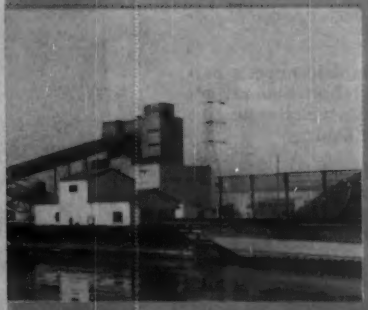


At left—sectional elevation of 325,000-kw unit now being installed at Waukegan. This unit is similar to the one just ordered for Crawford and the one being installed at Fisk.

WAUKEGAN STATION



CRAWFORD STATION



WILL COUNTY STATION

FISK STATION

PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; SOIL PIPE

Note this Nameplate Carefully—

TOOL OPERATED DISCONNECT

CAT. NO:	4752	KV, NOMINAL:	15
KV, MAX. DES:	15	KV, IMP. WITH:	95
AMP, CONT:	400	AMP, MOM:	20000

This is an S&C Tool Operated Disconnect. Used with S&C's Loadbuster, it can switch the circuit under any condition except short circuit—without external arcing.

U S PATENTS PENDING

S&C ELECTRIC COMPANY
CHICAGO

Made in U. S. A. G-3448

It means—

1. universal low cost load switching throughout your distribution system by use of LOADBUSTER®, the portable loadbreak tool; for loads up to 400 amperes and with system voltages through 14.4 kv;

2. station-type disconnect performance at distribution disconnect prices;

3. S&C stands behind this disconnect's performance with full published short-time ratings and insulation values—values which cannot be matched in the distribution field;

4. an inexpensive device for duties normally handled by group-operated disconnects, station-type stick operated disconnects, and conventional load interrupters.

Now look how Loadbuster works

Attached to a universal pole, LOADBUSTER is simply hung on the attachment hook of this new Tool Operated Disconnect, and the pull ring hook inserted in the pull ring. As the pole is pulled downward the disconnect is opened, LOADBUSTER trips, breaking the circuit positively. It's that easy!

S&C Electric Company, 4421 Ravenswood Avenue, Chicago 40, Illinois.
In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ontario.

NEWS-SCOPE

FUTURE NEWS ▶ **Underground distribution may serve more residential customers** as another large midwestern utility directs its engineers to reduce customer costs in its underground service policy.

Railway electrification is drawing some thought as railroad operating costs rise. Enormous initial capital outlay required makes changeover look remote. But an arrangement whereby utilities would get to use railroad rights-of-way, and railroads could get power from these utility lines—without having to buy generating equipment—might make electrification more attractive.

LATE NEWS ▶ **Engineer shortage is letting up,** says an Engineers Joint Council Survey. By asking 407 industries, 64 government agencies how many engineers they want, and how many they actually expect to hire, EJC found a 12.1% deficit in 1957. This is down from last year's 14.3% shortage. Industry this year expects to fill all but 2½% of its requirements. Bulk of the present shortage is hitting the government. But Civil Service pay raises for engineers announced last week may alleviate this. . . . The future? An EEI survey estimates engineer supply will lag demand by about 6% annually until 1960, by about 20% annually from '60 to '65. Look for other results of the EEI Engineering Manpower Survey in EW soon.

A ten-year demonstration reactor program with guarantees of federal financial aid to builders and operators of nuclear power plants has been suggested to AEC Chairman Lewis Strauss in a letter from Chairman Carl R. Durham of the Joint Committee on Atomic Energy. It is believed Strauss has agreed to staff meetings between AEC and the Joint Committee, but there's no clue yet as to his own thinking on the Durham proposal. (See p 87 for earlier story.)

Rockslide knocks out power to Aluminum Co of Canada's huge Kitimat smelter. Smelter was stopped cold and townsite (14,000 pop.) blacked out Dec. 8 when rocks crushed a steel tower and snapped transmission lines. Emergency diesels are supplying critical needs. Restoration expected within ten days.

Niagara Mohawk Power Corp gets PSC approval to take over the municipal electric system at Dunkirk for about $1,320,500.

SEC files suit in federal district court in New Orleans asking the court to approve its order of March 20, 1953, directing Louisiana Power & Light Co to divest itself of non-electric properties.

Congratulations . . . West Penn Electric Co makes changes at the top. Earle S. Thompson, formerly president, will continue as chairman and chief executive officer. Harold F. Butler jumps from vp to vice chairman. J. L. Rice, Jr, a vp since 1949, becomes president and chief administrative officer. Marion G. Miller is elevated from assistant vice president to vice president.

NEW EEI CHIEF ▶ **J. W. McAfee is the new president of EEI.** J. E. Corette succeeds him to the vice presidency. Board praises Donald S. Kennedy as he resigns (p 86).

SPACE HEATING ▶ **Load factors have risen since 1950** for over half the utilities that promote electric house heating. This shows up in EW's 1957 Electric Space Heating Survey. Heating still looks like the most promising load builder and balancer—even after a bad construction year and in spite of tough competition from other fuels. Promotion is pulling electric house heating northward. Most of the utilities that promote it have winter peaks, and almost ¾ of them are north of the 4,000 degree-day line. About 80% are "all-electric" companies. How do they push electric house heating? Their promotional programs take them into insulation, budget billing, and floor display, as well as the mass media. Promotion seems to be trending slowly upward, with 43% of companies surveyed taking part this year as compared to 41% in 1956. One utility executive contributing to this year's survey calls electric heating the only route to 10,000 kwhr average use (p 95).

Here's technical aid for the home heating program. A formula developed in Connecticut gives a new way to predict daily energy usage of an all-electric house during the heating season. Parameters of the equation are temperature, wind, sun, and appliances. Results show a high correlation with actual energy usage in three of four sample houses (p 104).

All a contractor needs is a tape measure, and Hartford Electric Light Co's simple table, to compute a room's heating requirements in a matter of a few minutes. Field tests show this short-cut process works. To see for yourself how easy it is, turn to p 108.

An all-electric motor court, served on one meter, brings almost $10,000 a year to Carolina P&L—and the service brings satisfied travellers back to the "South of the Border Motel" near Dillon, S. C. (p 126).

Promotional rates for house and water heating make electricity a tough competitor in Arkansas. And all over the U. S. electric utilities are setting rates to sell. Washington Water Power, with a promotional rate for water heating since 1914 claims 90% saturation. And at Missouri Power & Light Co, "rate discrimination" is not such a tough customer relations problem. In fact MP&L finds the few people who do call in to complain about it make excellent sales prospects (p 84).

EVENTS ▶ **Get into A-power while the gettin's good** was the challenge expressed by Middle South Utilities VP Paul Hallingby, Jr, at the recent Honolulu meeting of the Pacific Coast Electrical Association. Hallingby urged utilities to provide research & development funds for

promising nuclear reactors not yet at the demonstration stage (p 90).

General Electric Co slashed prices of its pole-type distribution transformers by about 4½%, effective midnight Dec. 6. It was said to be the first such sizeable price cut since 1938 (p 89).

The Sputnik reflex has caromed into the power field. Now Federal Power advocates are pointing to Soviet hydro-power buildup as a new reason for hikes in government spending for power development, rivers and harbors (p 88).

FINANCE ▶ **Three top utility men** visited the New York Society of Security Analysts recently. Chairman H. L. Nichols and Vice President Don D. Loden of Southwestern Public Service said the company expects to spend $80 million in the next five years—plans to raise $51 million in new securities to take care of the program. The balance will come from internal sources. President C. Hazen Stetson of Maine Public Service Co revealed that over 70% of his company's revenue comes from residential and commercial customers. Reason: no large industries in the territory (p 155).

INDUSTRIAL ▶ **A new set of mercury lights boosted production 25%** for Hetherington & Berner, Inc, an Indianapolis asphalt-mill manufacturer. Man-hours have been cut by 10%, and there hasn't been a "charge-back" on a production error since the lights were installed (p 135).

There's more to industrial safety than meets the eye. While thinking about system design, building layout, installation and maintenance of equipment in careful detail in order to avoid electrical accidents, engineers can't forget that people will make their own accidents given half a chance. H. E. Springer, Electrical Superintendent for Rayonier, Inc, offers a wealth of specific industrial safety tips on subjects ranging from tagging procedures to switchroom ventilation. Some tips are technical; some, administrative; all are practical (p 92).

PEOPLE ▶ **Pacific Power & Light Co** has named Charles E. Oakes chairman of the board. Jack K. Busby, former executive vice president, succeeds him to the president's slot . . . New England Electric System has elevated five men to key executive posts: R. F. Krause, R. E. Nock, A. V. Coleman, E. G. Twohey, and C. W Jones (p 146).

MANUFACTURERS ▶ **Lower meter maintenance costs** are promised with a manually-operated meter by-pass now ready for market. The by-pass permits meter changing with no interruption of customer service. Only equipment needed—a screwdriver (p 161).

NEW EQUIPMENT ▶ **Oil switch** uses resistors in series with arcing contacts to limit high-frequency inrush currents during capacitor step switching. The switch can be operated remotely (p 136).

ENGINEERING TRENDS

Evaluation of meter testing is aided by recognition that 100 meters must be tested to find those needing recalibration when periodic tests show 98% meeting accuracy standards. This approach gives emphasis to the value of sample testing as means of selecting meters most likely to need maintenance, recalibration, or replacement.

Great Britain will build two full-scale process plants for complete gasification of coal in its search for cheaper gas sources. Lurgi process will be used. Also under consideration as methods of obtaining gas are: hydrogenation of both coal and oil, use of surplus products from refineries, import of methane in liquid form, and drainage of methane from local pits.

Use of pressurized water in nuclear power reactors makes the availability of a graphical presentation of the thermodynamic properties of compressed water very desirable. A chart to meet this need has been developed to cover the temperature range 32 to 705.4F and the pressure range 0.08854 to 6,000 psi. Enthalpy is plotted against entropy with lines of constant pressure, temperature, and specific volume.

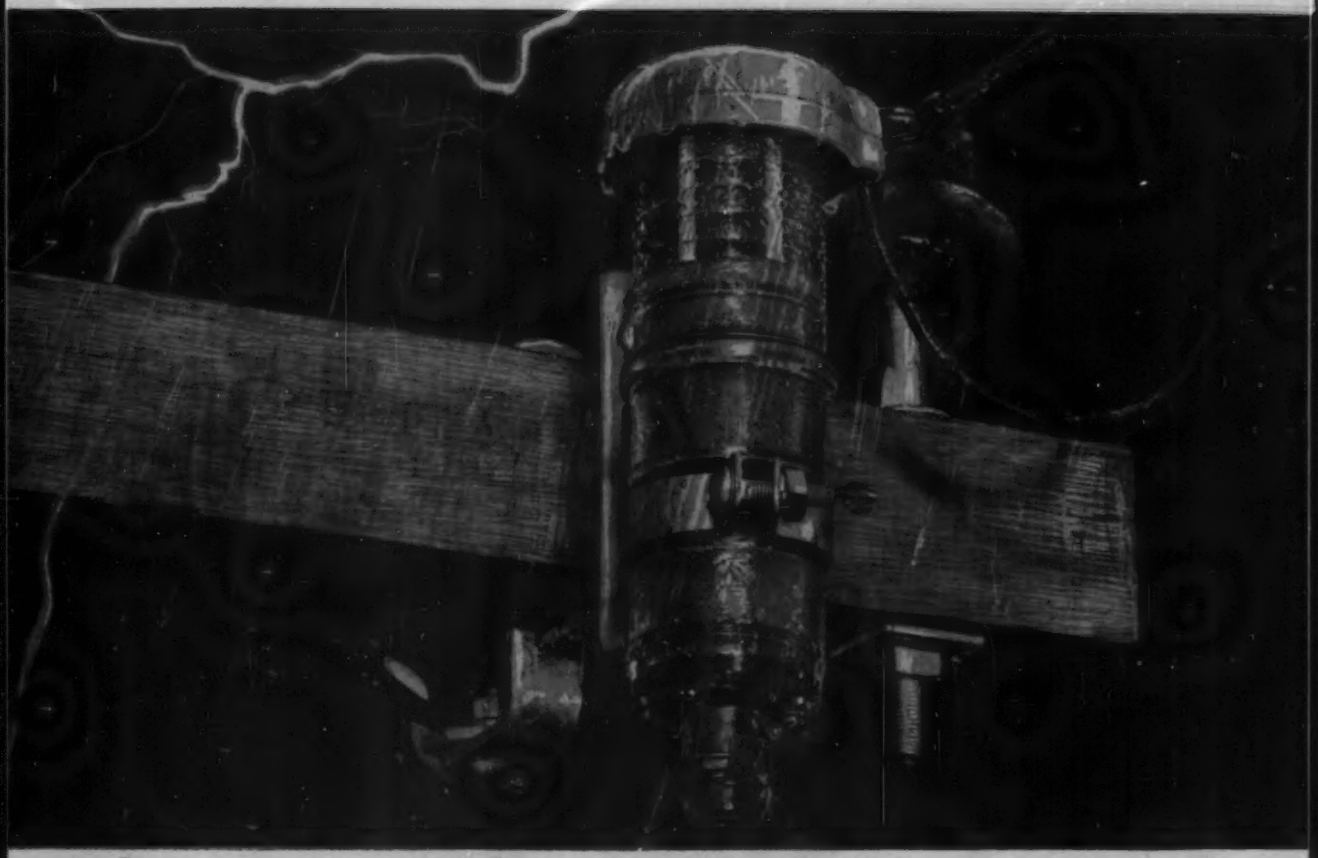
Electric ranges apparently bear no peak responsibility where air conditioning is the predominant load. A recent appliance load characteristic survey made by a utility indicates that the distribution system and the entire system design must be based on air conditioning load.

FROM EDITORS IN THE FIELD

Doubling of cable capacity by means of supplementary water cooling will be attempted with an installation of four 115-kv, oil-filled cable circuits by Hydro Electric Power Commission of Ontario. A small-bore polythene pipe carrying cold water will be laid on each side of the center cable of each circuit. At regular intervals the heated water will be replaced by fresh cold water. Use of this additional cooling system adds only 5% to total cost.

Ultrasonic cleaning of meter registers can work too effectively, reports one eastern utility. If the process is not watched carefully, it can wash out the paint in the manufacturer's serial number.

Bundling secondary bus and service at a two-pole platform structure supporting high-capacity 3-phase bank is saving a southeastern utility both time and material. Benefits are gained by eliminating the conventional bus and running the multi-conductor secondary from transformers to the customer. Between the poles the secondary is supported on guy wires.



Why More Utilities Are Selecting L-M Type E Valve Arresters

L-M valve-type distribution lightning arresters have established an outstanding performance record by giving millions of service years of reliable protection. The Type E has been a leader in the field, and hundreds of thousands have been giving excellent service for many years. The failure rate is phenomenally low.

Here are some of the reasons for this remarkable record, and for the great increase in customer preference for the L-M Type E valve arrester.

Balanced Sparkover: Spark gap is a ladder-gap design, pre-set and then permanently sealed in the arrester housing. It cannot be knocked or burned out of adjustment. Gap is precision-made to assure optimum balance between 60-cycle sparkover and impulse sparkover.

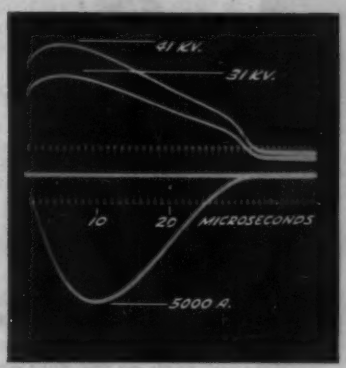
Low IR Drop: L-M now has a new Type E arrester, the E-3, which provides even lower IR drop than its popular predecessor. The new Type E-3 also provides greater durability and discharge capacity. These advantages are made possible because the new Type E-3 has an improved gap which provides greater 60-cycle interrupting ability, permitting reduction of the resistance of the valve element. The oscillogram shows the improvement in IR drop between the Type E and the new Type E-3.

Positive Protection: L-M valve arresters have a Pyrex glass housing which permits visual inspection of the spark gap in the field. Should the arrester become damaged, telltale evidence can be readily seen through the glass. If the arrester should fail to interrupt 60-cycle follow current for any reason whatsoever, L-M's patented Isolator provides positive assurance against grounding the feeder by disconnecting the ground lead from the arrester.

Other features include Zincilated (Zincilate No. 100) arrester housing clamp, fibre-glass cap, and fibre-form packaging. New packaging provides additional strength to the carton so arresters can be stacked easily on pallets.

Get Complete Information

Get the whole story of L-M arrester performance and application. Ask the L-M Field Engineer, or write for a copy of bulletin on the new Type E-3 arrester, to Line Material Industries, Milwaukee 1, Wisconsin.



Oscillogram shows reduction in discharge voltage in the new Type E-3 valve-type lightning arrester. Curves are for a 9 kv unit. IR drop has been reduced from 41 kv to 31 kv—a remarkable improvement in a unit that already has established an enviable performance record over many years' service.

LINE MATERIAL Industries

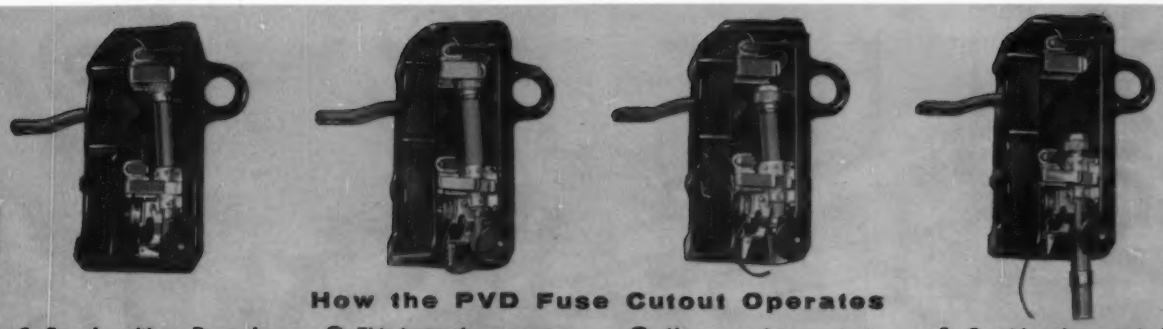
McGRAW-EDISON COMPANY

IM Lightning Arresters

McGRAW EDISON

DOOR IS EASY TO OPEN. Handle is high up on the door to assure good leverage, and hole is large enough to insert hookstick easily, yet small enough so hook will not slide down or jump out. Available in standard-duty ratings and new heavy-duty interrupting ratings of 5000 amps. at 5.2 kv and 8000 amps. at 2.6 kv.

THE DOOR IS REMOVED, unhooked, and replaced, all with the hookstick. A special hook on the door assembly makes this convenient.



How the PVD Fuse Cutout Operates

1. Fused position. Door always closed—operation is independent of door. As the link blows, spring-loaded lever flips out the fuse link leader—fast!

2. This instantly separates blown link parts, clearing the arc inside the tube. It also releases a latch which permits the bright yellow fuse tube to drop out.

3. Upper spring contact pushes the tube down and follows it part way, giving extra time to clear the arc, and eliminating burning of contacts. Action is positive.

4. Cartridge drops to indicating position easily seen from the ground. Large air gap prevents re-establishing the arc. No leakage, no radio interference.

How L-M's Famous PVD® Cutouts Provide Faster, Safer Operation

Positive dropout operation provides indication easily seen from the ground. For re-fusing, door is easily removed and replaced with hookstick; high-pressure silver contacts insure long life. Now also available in heavy-duty designs.

By **GEORGE W. COOPER**
Product Manager
Protective and Power
Switching Equipment
Line Material Industries

When a fuse blows in L-M enclosed dropout cutouts, a latching lever flips out the fuse and permits the cartridge to drop to indicating position. Upper contact spring follows tube part way, giving extra time to clear arc inside the tube. Contact spring also provides a downward thrust on the tube to assure positive dropout operation.

The large air gap which results between the tube and the upper contacts on the box prevents re-establishing of the arc. This assures long service, eliminates leakage and possible radio interference. Door remains closed following fuse operation; parts are always protected.

Positive Low-Resistance Contact

L-M's silver-plated spring contacts and round blade provide a very high-pressure, multi-point contact surface. In addition to the side contact clips, the spring-top clip provides additional contact and current path.

L-M's heavy contact construction provides ample metal to conduct heat away rapidly from the multi-point contact surface. This results in cool operation, and resistance is kept low.

Blown Fuses Easily Located

When the cartridge in L-M's enclosed cutout is in indicating position, it is easily seen from the ground—from any angle. The lineman locates the blown fuse quickly; thus he saves operating time and restores service faster.

Easy To Re-Fuse With Hookstick

The pull ring handle on L-M's PVD cutouts is high up on the door to assure good leverage when operating the door. This, plus a hook on the flipper assembly, make it easy to open and unhook the door, and to replace it with a spare fused door, the whole job being done with the hookstick . . . in just a few seconds.

In the open position, all parts of the door and cartridge assembly are electrically dead.

When the door is closed, the two hinges and the lower contact hold the door and cartridge assembly firmly. This, plus the guiding action of the top contact, assures that the door will close properly every time.

L-M Family of Dropout Indicating Cutouts

Interrupting Capacity Amp.	5.2/2.6 kv		7.8 kv	
	50 Amp.	100 Amp.	50 Amp.	100 Amp.
2000/3000	PVD			
3000/5000		PVD		
5000/8000	PHV*	PIV*		
2000			PVD	
3000				PVD

**New heavy-duty ratings*

In addition to the dropout indicating cutouts above, L-M offers a complete line of non-dropout indicating and non-dropout fuse cutouts.

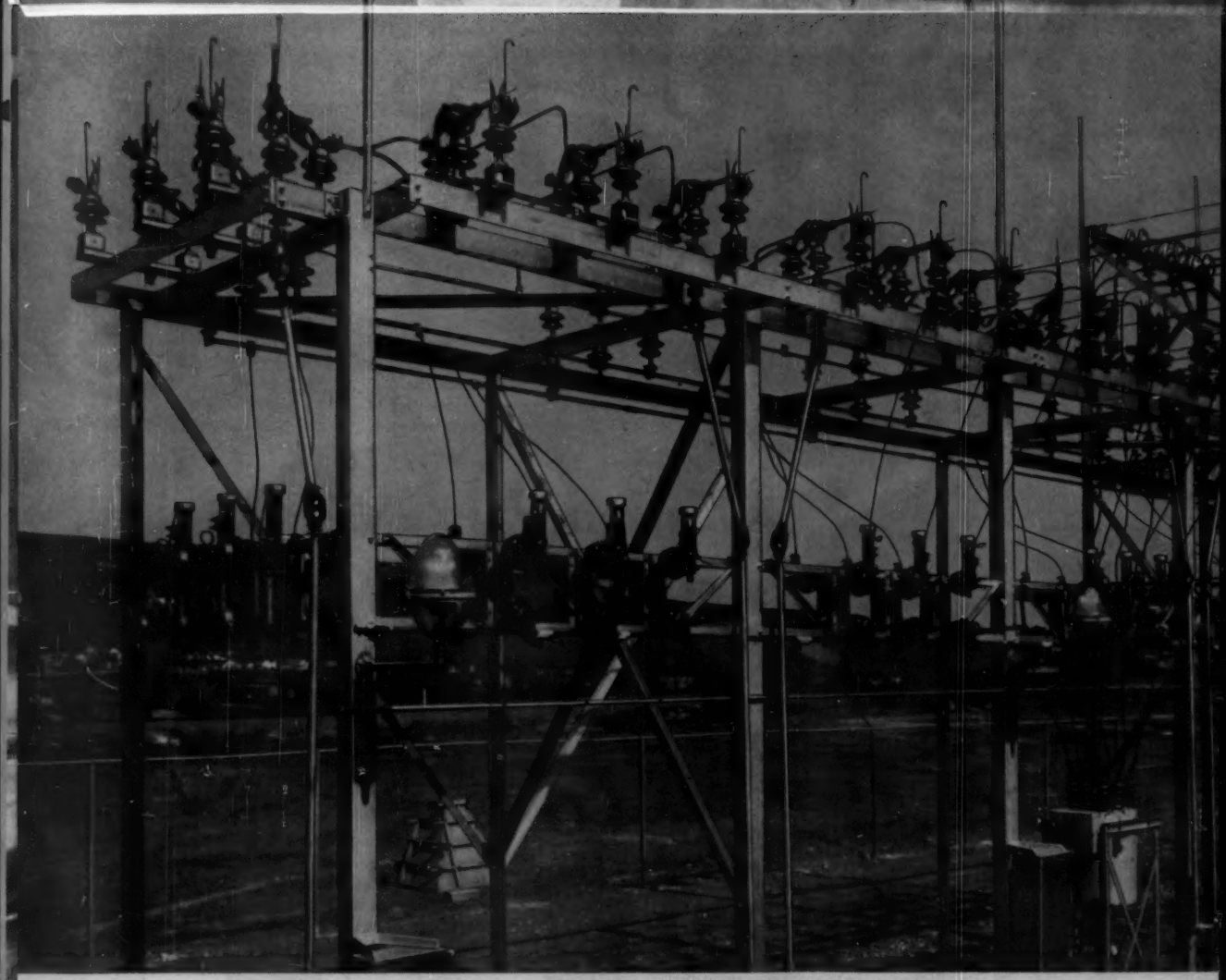
Ask your L-M Field Engineer for more complete information, or write Line Material Industries, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ont.

LINE MATERIAL Industries
McGRAW-EDISON COMPANY
fuse cutouts and fuse links

318

McGRAW EDISON

Silicone Cord Ring



Nine L-M power switches and 20 hook switches at the 13.8 kv 20,000 kva switching center of a Northwest utility. L-M also furnished other equipment and apparatus.

How L-M Switch Design Insures High Thermal Capacity, Positive Operation

High-pressure silver-to-silver contacts provide cool operation; powerful lever advantage to open and close switch insures easy operation at all times.

by **HARVEY BAERWALD**
Sales Application Engineer
Power Switching And
Substation Section
Line Material Company

Line Material has designed high thermal capacity and trouble-free operation into its line of power switches. Powerful lever advantage of the operating mechanism and silicone-grease-lubricated and sealed bearings at all moving joints insure positive operation to open or closed switch position regardless of ice, corrosion, or long periods of non-operation.

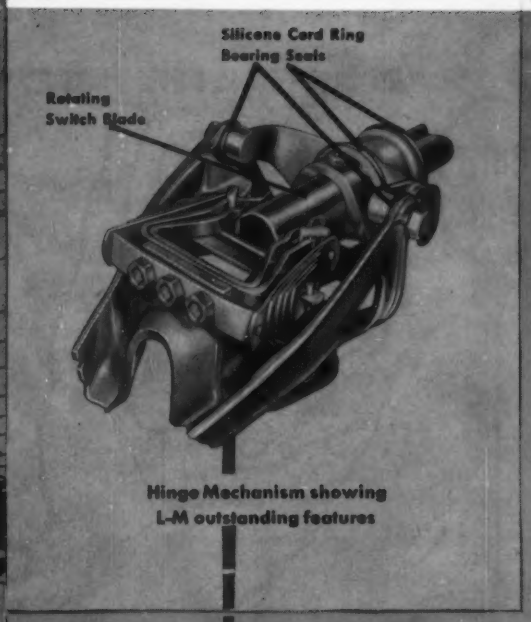
Tremendous Lever Advantage

Operating mechanism provides a tremendous lever advantage by utilizing unique rotating switch blade design. Before the blade even begins to rise in the contacts, it is rotated 26 degrees—the full force is applied to blade rotation, breaking any possible condition of ice, corrosion, or contamination.

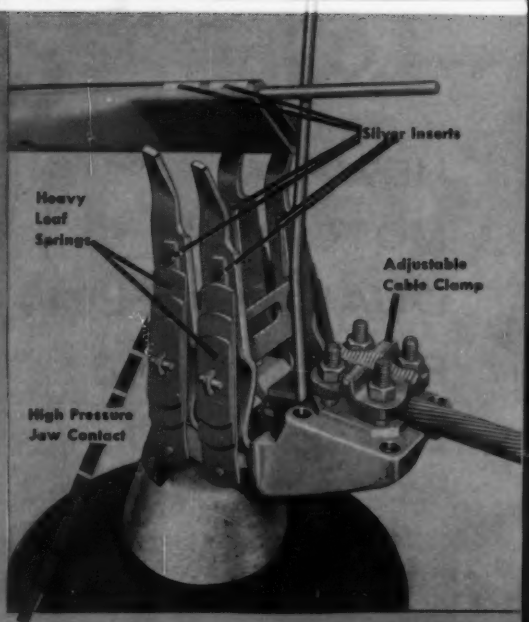
Smooth, Easy Operation

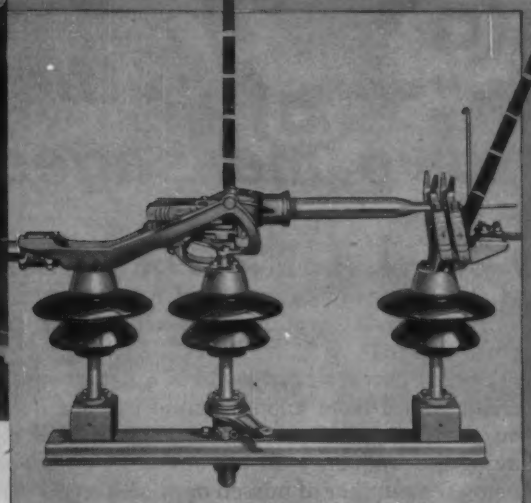
The hinge operating mechanism also provides smooth, positive blade rotation and blade rise. All bearings and all moving joints on the switch and on the interphase mechanism assembly are silicone-grease-lubricated for life and positively sealed with silicone cord rings.

LINE MATERIAL
McGRAW-EDISON COMPANY

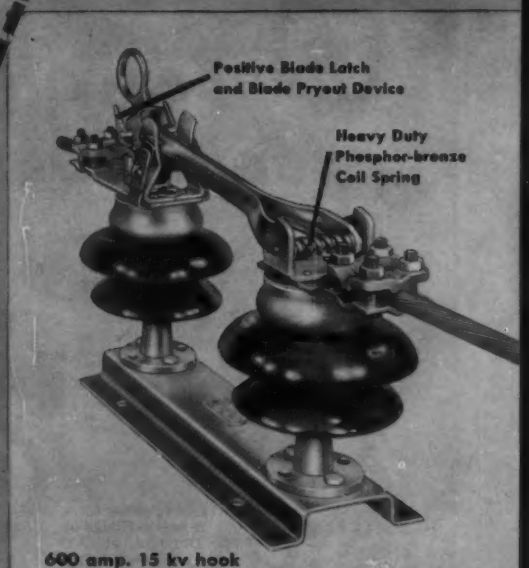


Hinge Mechanism showing
L-M outstanding features





1200 amp. 34.5 kv vertical break
type PV switch



600 amp. 15 kv hook
stick operated Disconnect Switch

Grease can't get out; water, dust, or dirt can't get in to freeze or start corrosion.

On 69 kv ratings and above, a counterbalance spring is provided to counteract blade weight. It is a self-centering, double coil, floating spring which is positive acting and trouble-free.

High Thermal Capacity

L-M's power switching equipment provides extremely high thermal capacity for both continuous current and short-time high current carrying applications.

Silver inlays in both blade and contact shoes insure high current-carrying capacity at both jaw and hinge contacts. During the closing operations, blade rotation provides a wiping action assuring clean silver-to-silver contact surfaces.

The jaw contact assembly has large copper shoes which exert 175 pounds pressure on the silver-to-silver contacts. This high pressure is maintained by heavy leaf springs to provide uniformly high thermal capacity.

L-M's power switches also have fewer current interchange points because the terminal connectors are designed as an integral part of the contact adapter.

Simple Construction

Turnbuckle interphase adjustments make L-M group-operated switches easy to install. Flexible interphase mechanism assures positive operation without periodic maintenance, even after the structure has become severely distorted.

Get Complete Information

Ask your L-M Field Engineer for information and bulletins on L-M's Power Switching Equipment. Or write Line Material Industries, Milwaukee 1, Wis.

Power Switching Equipment

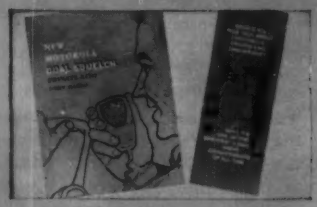
256-B

NEW
MOTOROLA
DUAL-SQUELCH
PRIVATE-LINE
2-WAY RADIO...

silences all channel traffic except your own messages

POWER

PRIVATE-LINE radiophone is now available in T-POWER (shown above), which features a completely transistorized power supply, as well as TWIN-V radio with 6/12 volt operation.



Get the complete facts about this startling new type of 2-way radio. Write today for these 2 new folders on PRIVATE-LINE radiophone.

Now, with the new Dual-Squelch PRIVATE-LINE radio, you get all the benefits of improved PRIVATE-LINE operation . . . *plus* easy integration for mixed fleets and monitor-before-transmit.

Because PRIVATE-LINE radio is quiet except when receiving a call from another radio in your own system, you eliminate all the "channel chatter." It's much like having the frequency all to yourself. You benefit by reducing the number of missed or misunderstood messages . . . operator fatigue is reduced . . . overall efficiency is increased.

Dual-Squelch PRIVATE-LINE radio gives you these basic features . . . and more. Now you can make a gradual changeover to PRIVATE-LINE operation. During the transition period, your messages can be received by both Motorola conventional and PRIVATE-LINE radios. No longer is it necessary to make the complete changeover to PRIVATE-LINE operation at the same time. And with the new Dual-Squelch operation, you can have manual selection or optional automatic monitoring of the channel before transmitting.

Before you select your 2-way radio, you'll want to investigate Motorola Dual-Squelch PRIVATE-LINE radio.

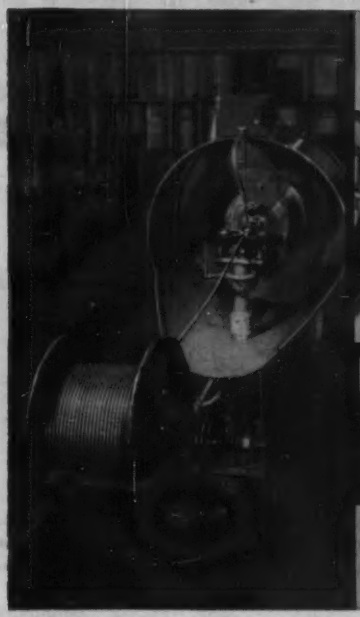
MOTOROLA PRIVATE-LINE RADIOPHONE

MOTOROLA Communications & Electronics, Inc., A Subsidiary of Motorola, Inc., 4501 Augusta Boulevard, Chicago 51, Illinois

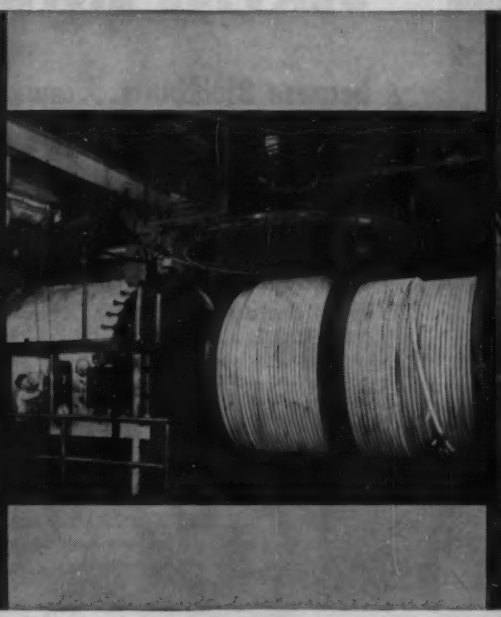
GENERAL CABLE

PAPER INSULATED
VERSATILE · RELIABLE
POWER CABLES

Manufactured at BAYONNE, N. J. • ST. LOUIS, MO. • EMERYVILLE, CALIF.



This machine forms steel strip into helical coil ducts or channels for use in gas filled or oil filled cable.



Impregnating Tank utilized in the heat-vacuum drying and oil impregnation steps in the manufacture of Paper Power Cable.

Large Cabling Machine used in cabling individually insulated conductors into multiple conductor assemblies.

- **SOLID TYPE**
- **LOW PRESSURE GAS FILLED**
- **LOW PRESSURE OIL FILLED**
- **PIPE TYPE**
  - **High Pressure Gas Filled**
  - **High Pressure Oil Filled**

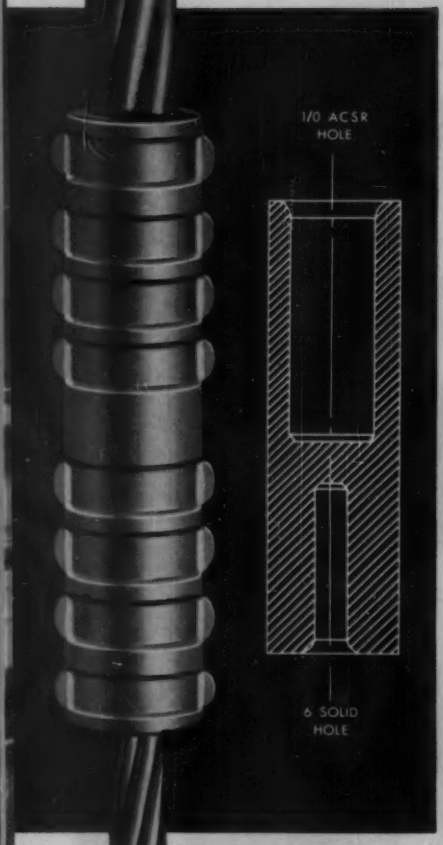
The excellent operating record over many years and the superior electrical characteristics of paper insulated cable highly recommends its use for all power applications. Paper Power Cable is a predominant type in preference and use for voltages above 5 KV.

General Cable Corporation is equipped with the finest modern facilities for paper taping and with many years of know-how is in a position to supply a high quality product for all low and high voltage applications.

GENERAL CABLE CORPORATION
420 Lexington Avenue, New York 17, N. Y.
Offices and Distributing Centers Coast-to-Coast

for quality and economy... **specify GENERAL CABLE**

You get HIGHER CONDUCTIVITY with BLACKBURN SERVICE ENTRANCE SLEEVES



because Blackburn... and Blackburn alone... provides GREATER CONTACT AREA where needed

Hole Depth Increases With Size of Conductor... thereby providing more contact area for the conductors being connected.

COLOR CODE	WIRE SIZE ACSR	WIRE SIZE AWG	HOLE DEPTH IN INCHES
Brown	–	8 sol — 10 str	.820
Green	–	6 sol — 8 str	.840
Blue	6	4 sol — 6 str	.860
Orange	4	2 sol — 4 str	.925
Red	2	1 sol — 2 str	1.010
Yellow	1/o	1/o str	1.185

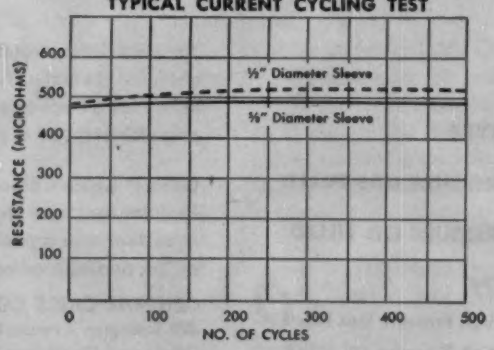
The center stop in a Blackburn Sleeve is a solid barrier that assures proper distribution of the inhibitor around the conductors.

FIRST! Printed (not indented) permanent COLOR CODING *is easier to read*—makes size identification positive and quick.

FIRST! Aluminum Sensitized Tape seals the Blackburn Sleeve's ends. Easy to puncture... and, if a particle of the seal is pushed into the chamber, it is conductive.

FIRST! Each Blackburn Sleeve contains the superior Blackburn inhibitor, Contax, *in measured amount*. Won't squirt out on glove or in face.

Conductivity of Connection PROVED GREATER Than Equivalent Length of The Conductors Being Connected.



A series of typical current cycling tests were conducted with both ½" x ⅜" diameter BLACKBURN Sleeves. Note the lower resistance of Blackburn Sleeves as compared to the equivalent length of cable without any sleeve.

Test Conditions

Wire: 2 ACSR to 4 stranded copper
Current: 190 Amperes
Cycle: 2 Hrs. "On" 1 Hr. "Off"
Length of Connection: 24 inches
Curves represent an average of five tests
Resistance of equivalent length of wire: 527 Microhms

LIVE BETTER ELECTRICALLY

JASPER BLACKBURN CORPORATION, 1525 Woodson Rd., St. Louis 14, Mo. • WYdown 3-9430

General Electric announces

New transistorized power supply for two-way radio

General Electric now brings you the vastly improved reliability of transistors — *without obsoleting your present equipment!*

The all-new General Electric Transistorized Power Supply—part of G.E.'s advanced Progress Line—replaces the receiver portion of the mobile power supply and eliminates the receiver vibrator.

Here's what this means: Previously you had to replace receiver vibrators several times a year. Our surveys indicate each replacement costs you from $10 to $18, depending upon service call mileage. Now you can install a power supply costing only $54.50 (when installed in new equipment at the factory, just $44.50) which has the same life expectancy as your entire mobile combination. *The new G-E Transistorized Power Supply will easily pay for itself the first year or two on vibrator replacements and service calls!*

Easy to install—Three mounting studs fasten the new unit to the front of your case or inside the older, two-unit design equipment. Electrical connections are simple: only four leads to attach.

Eliminates "Vibrator Hash" — All traces of the "vibrator hash" which interferes with clear reception are gone for good.

Easily added to any 12-volt system — The new power supply can be used with all standard makes of two-way equipment which operate from an ordinary 12-volt power source.

Saves you money when drivers forget—When drivers neglect to turn off their radios before starting a vehicle, the new transistorized power supply cannot be damaged.

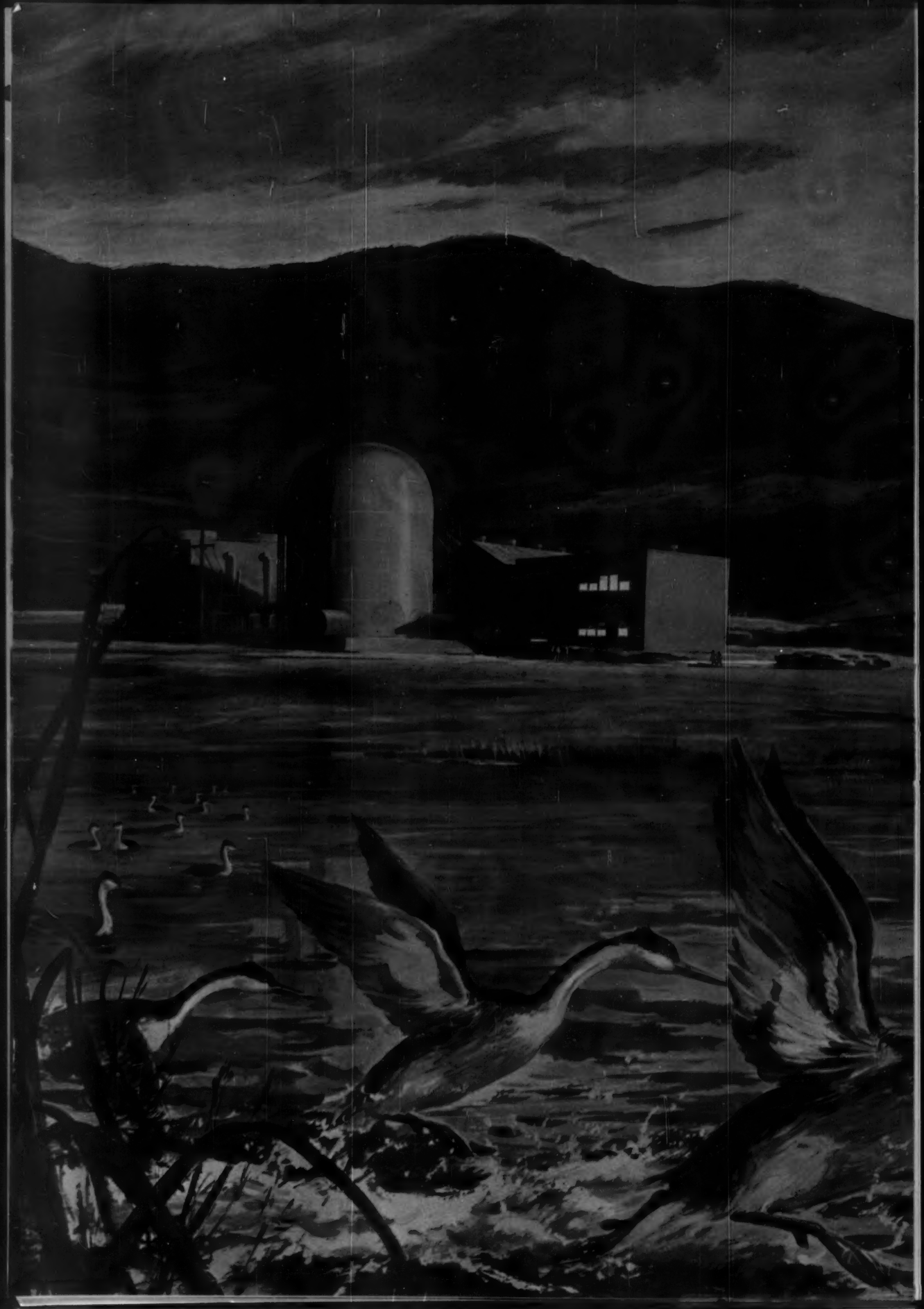
Progress without obsolescence — The addition of the new unit to your present mobiles, no matter what make, improves performance, reduces maintenance cost, and adds to the life of your equipment. *There is absolutely no need to buy complete new mobile units to enjoy the advantages of transistors.*

3-WAY MOBILE RADIO

See for yourself how much you save—buy a new unit or several units and try them in your own 12-volt mobile units. Call your G-E communications consultant, listed under "Radio Communication Equipment" in the Yellow Pages. Or order direct by writing General Electric Co., Communication Products Dept., Syracuse, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC



Vallecitos Atomic-Electric Power Plant...

ON THE LINE

Nation's first privately financed atomic power plant begins operation

On October 24, 1957, this country's first all privately financed atomic-electric power plant began feeding 5,000 kw of electricity into the Pacific Gas and Electric Company's transmission network. The General Electric boiling water reactor which furnishes steam to a conventional turbine-generator, owned and operated by PG&E, was issued power reactor License No. 1 by the Atomic Energy Commission.

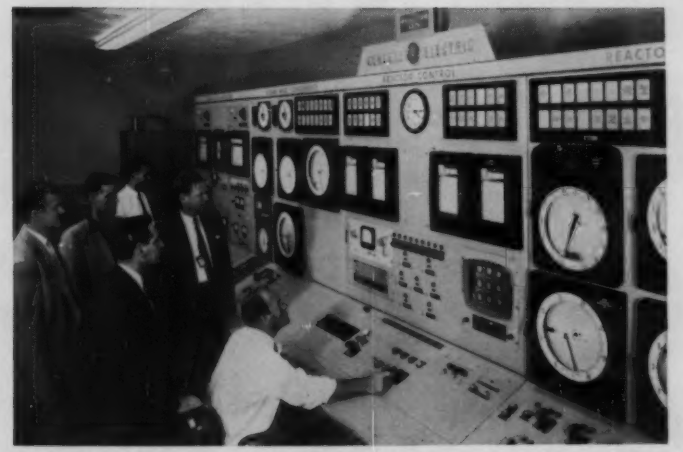
Operation of the reactor has been successful: the system is stable, responds quickly to load changes, and steam capacity is greater than presently licensed limits. Low radioactivity level permits direct maintenance of the turbine during operation.

Located at the General Electric Vallecitos Atomic Laboratory, the reactor is now providing operational data for the 180,000-kw Dresden Nuclear Power Station which General Electric is building for Commonwealth Edison Company and the Nuclear Power Group, Inc.

Designed and built by General Electric in co-operation with Pacific Gas and Electric, a member of the Nuclear Power Group, the Vallecitos Atomic-Electric Power Plant is a tangible step forward in the development of economic commercial nuclear power. Atomic Power Equipment Department, General Electric Company, San Jose, California. 197-6

Progress Is Our Most Important Product

GENERAL ELECTRIC



5000 kw was generated Oct. 24, 1957, at Vallecitos Atomic Power Plant, 17 months after ground-breaking. The General Electric reactor, built at a cost below original estimate, operates on AEC power reactor License No. 1.

The Powerful Power-Groove!

Radical new General Electric fluorescent lamp design can give your customers higher, more economical light levels

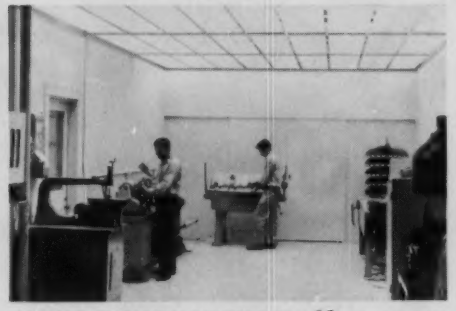
AT ERICKSON TOOL COMPANY (above), 450 G-E Power-Grooves, eight feet long, mounted 10 feet high, with 10 feet between rows, maintain a lighting level of 160 footcandles economically. This means there is plenty of light right at the machines (see footcandle reading at right)—where extra light means extra safety, extra accuracy for workers. No supplementary lighting is needed. Powerful Power-Grooves do it all!

While plans for their new building were still in the early stages, officers from Erickson Tool Company of Cleveland, Ohio, visited the Lighting Institute—General Electric's lamp headquarters at Nela Park. There they saw the whole array of lighting methods and discussed the powerful new G-E Power-Groove Lamps.

They were shown how these revolutionary lamps provide outstanding general lighting, making it unnecessary to use supplemental lighting on individual machines (like that used by Erickson toolmakers in their old plant). They saw how powerful Power-Grooves would fill a plant with pleasant light that's easy on the eyes . . . as well as the pocketbook. The decision was made: Erickson's new plant would have G-E Power-Groove Lamps throughout!

Because G-E Power-Groove Lamps give nearly twice as much light per tube as High-Outputs—2½ times as much as 8-foot slimlines—your customers can get more light per fixture—with fewer parts to maintain. And compared to other fluorescent systems, they can save 5-20% on their initial investment.

Get the whole exciting Power-Groove story. Write General Electric Co., Large Lamp Dept. WE-127, Nela Park, Cleveland 12, Ohio. Better still, visit Nela Park and let us show you on-the-spot demonstrations of how the powerful Power-Grooves can work for your customers.

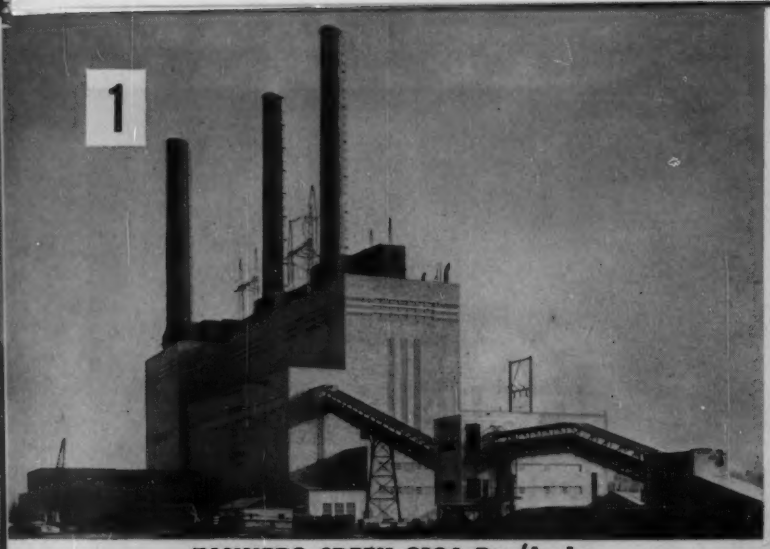


WORLD'S BRIGHTEST WORKSHOP—Now you can see powerful Power-Grooves in action . . . lighting the world's brightest workshop. It's at the G-E Lighting Institute at Nela Park. Plan to visit it and see for yourself.

Progress Is Our Most Important Product

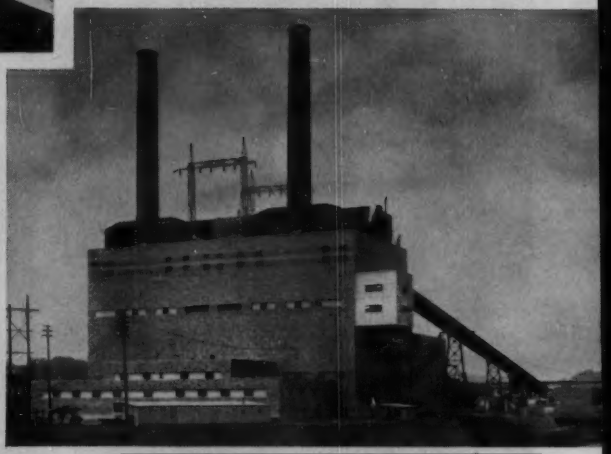
GENERAL ELECTRIC

Among the 50 largest utilities,
only one electric or telephone
utility is a Preformed prospect...
the rest are
Preformed customers
In July, 1947, Preformed Line Products Company didn't have a customer; all the electric and telephone utilities were prospects. Today, the situation is almost completely reversed.
For example, in FORTUNE's list of the "Fifty Largest" utilities, only one of the *electric* and *telephone* utilities mentioned is still a prospect; all the rest are now Preformed customers. In other words, the Preformed principle of using preformed helical rods for line accessories has gained almost complete acceptance in only 10 years.
If you are among the few utilities not utilizing Preformed, you might ask "Why?". PREFORMED LINE PRODUCTS COMPANY, 5349 St. Clair Avenue, Cleveland 3, Ohio. Cable Address: Preformed-Cleveland
...in 10 years the leading manufacturer or armor rods, dead-ends, Guy-Grip dead-ends, splices and other line accessories.
PLP
You can look up to Preformed

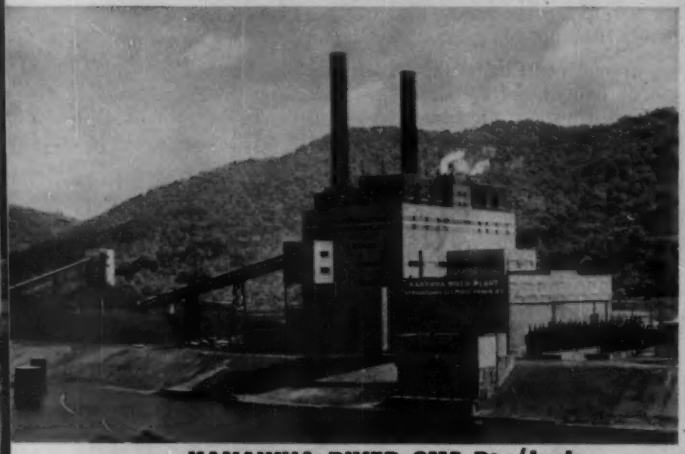


TANNERS CREEK 9106 Btu/kwhr
Indiana & Michigan Electric Co. on the American Gas and Electric System
Three B&W Pressure-Fired Radiant Reheat Boilers

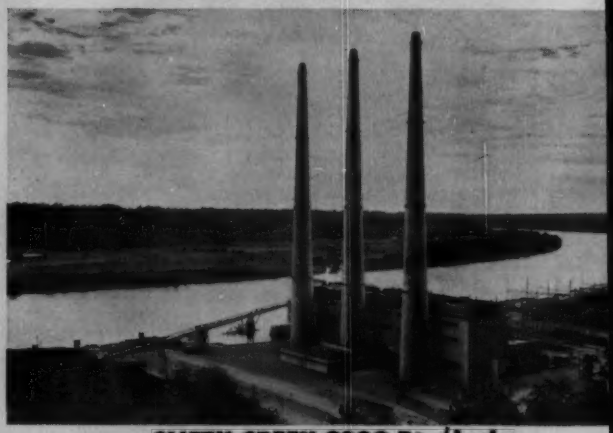
MOST EFFICIENT HEAT RATES IN THE POWER INDUSTRY



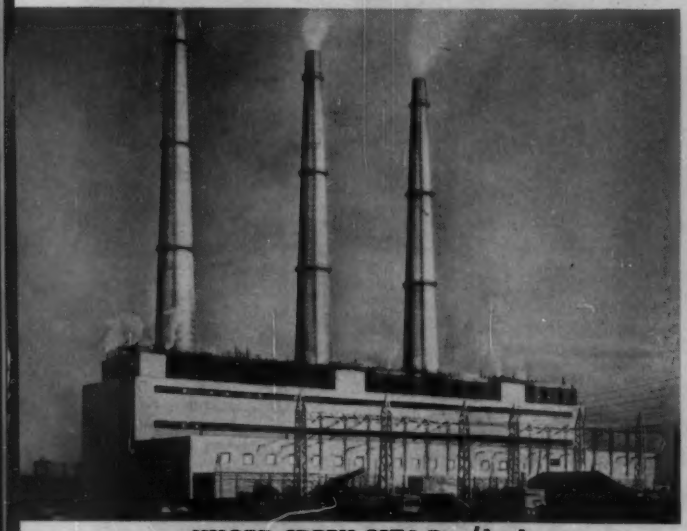
MUSKINGUM RIVER 9176 Btu/kwhr
Ohio Power Co. on the American Gas and Electric System
Two B&W Pressure-Fired Open-Pass Reheat Boilers



KANAWHA RIVER 9115 Btu/kwhr
Appalachian Electric Power Co. on the American Gas and Electric System
Two B&W Pressure-Fired Radiant Reheat Boilers

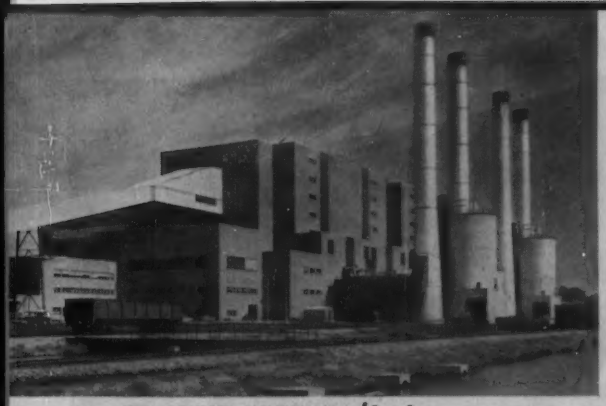


CLIFTY CREEK 9200 Btu/kwhr
Indiana-Kentucky Electric Corporation†
Six B&W Pressure-Fired Open-Pass Reheat Boilers

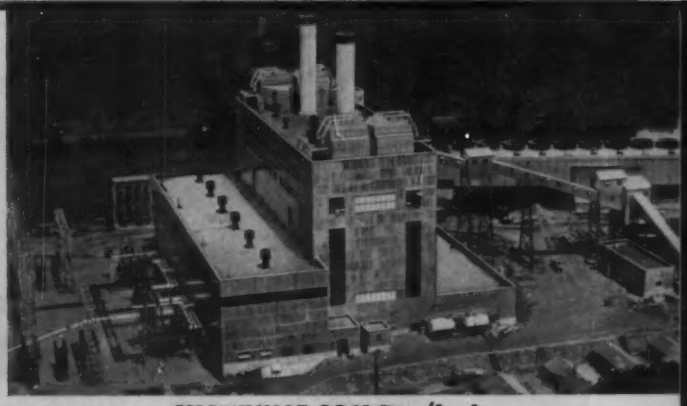


KYGER CREEK 9176 Btu/kwhr
Ohio Valley Electric Corporation†
Five B&W Pressure-Fired Open-Pass Reheat Boilers

JOHN SEVIER 9221 Btu/kwhr
Tennessee Valley Authority



ST. CLAIR 9200 Btu/kwhr
Detroit Edison Co.
Four B&W Radiant Reheat Boilers



SHAWVILLE 9241 Btu/kwhr
Pennsylvania Electric Co.
Two B&W Radiant Reheat Boilers

RIVER ROUGE 9210 Btu/kwhr
Detroit Edison Co.
One B&W Radiant Reheat Boiler

BAY SHORE 9282 Btu/kwhr
Toledo Edison Company
One B&W Radiant Reheat Boiler

B&W Engineering Developments Pay Off in Power Plant Efficiency

Nine Out of Nation's Top Ten Have B&W Boilers

Here are the ten most efficient power plants in the United States in 1956 as reported by the Federal Power Commission. Their achievement reflects the signal success of the power industry in keeping electricity America's best bargain despite rising fuel and other costs.

A major investment in engineering research and development has made possible these great strides in power plant efficiency. Six years ago only two plants operated under 10,000 Btu per net kwhr. In 1956 there were no less than 47. In addition a great many new units incorporated in older plants are now operating at these high efficiencies. It is significant that nine out of the nation's top ten plants in terms of efficiency are equipped with B&W boilers.

B&W's role in this vital industry has been a crucial one, covering nearly a century of boiler engineering, design and fabrication. Today, millions of dollars are being invested in major B&W engineering developments—such as the Universal Pressure Boiler, utilization of low grade fuels, basic metallurgical research for high temperatures, and nuclear energy—all to help America's utilities continue to supply abundant, economical, reliable electricity. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.

G-877-CS

† Ohio Valley Electric Corporation and its subsidiary, Indiana-Kentucky Electric Corporation, sponsored by these companies:
Appalachian Electric Power Company* • The Cincinnati Gas & Electric Company Columbus and Southern Ohio Electric Company • The Dayton Power and Light Company • Indiana & Michigan Electric Company* • Kentucky Utilities Company • Louisville Gas and Electric Company • Monongahela Power Company** Ohio Edison Company • Ohio Power Company* • Pennsylvania Power Company*** • The Potomac Edison Company** • Southern Indiana Gas and Electric Company • The Toledo Edison Company • West Penn Power Company**
* Subsidiary of American Gas and Electric Co. ** Subsidiary of The West Penn Electric Co. *** Subsidiary of Ohio Edison Co.

BABCOCK & WILCOX
BOILER DIVISION

Another KUHLMAN transformer on its way to help build a new Korea

KUHLMAN "Salesman of the Week"

If you can identify this Kuhlman representative, notify Dept. SA-1, Kuhlman Electric Co., Birmingham, Michigan

Electrical progress, under the United Nations Korean Reconstruction Agency, is building a new, stronger Korea. Kuhlman, in serving UNKRA with dependable transformers, is proud to help strengthen the Korean electrical, power and manufacturing industries. World-wide acceptance of proven Kuhlman transformers is another assurance of your complete satisfaction with any Kuhlman product.

KUHLMAN
ELECTRIC COMPANY
GENERAL OFFICES, Birmingham, Michigan

5722 C

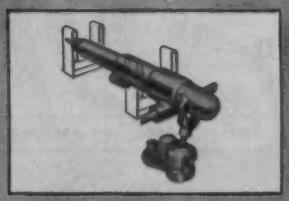
EXPORT REPRESENTATIVES: International Standard Electric Corporation • 50 Church Street, 15th Floor • New York 7, New York • Cable Address: Microphone, N. Y.

1. SWITCH BLADE IN FULLY OPEN POSITION

Universal link connects blade and crank arm for transmitting forces to the switch blade for full cycle of operation.

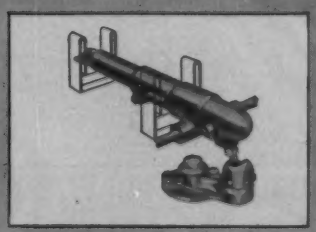
2. SWITCH BLADE CLOSING

Switch blade is moved from the open to closed position by a relatively small angular motion of the crank arm.



3. SWITCH BLADE ENTERS CONTACTS

In this position the switch blade begins its rotation for full contact engagement. Continued movement of the crank arm will rotate the blade to bring contacts under high pressure.



4. SWITCH WITH CONTACTS FULLY ENGAGED

The simple linkage of the WAG concentrates mechanical advantage so that contact engagement or disengagement is accomplished with a minimum of effort.

Simple WAG linkage boosts mechanical advantage; lessens operating effort

In one sweeping, continuous movement the Type WAG Switch blade swings into the open or closed position. There is no lost motion — no cams, triggers, or latches.

The WAG is operated by a simple system of cranks and levers arranged to transmit maximum torque when the blade rotates to engage or disengage the contacts. By concentrating mechanical advantage where it is needed most, the WAG can be operated smoothly and with less effort.

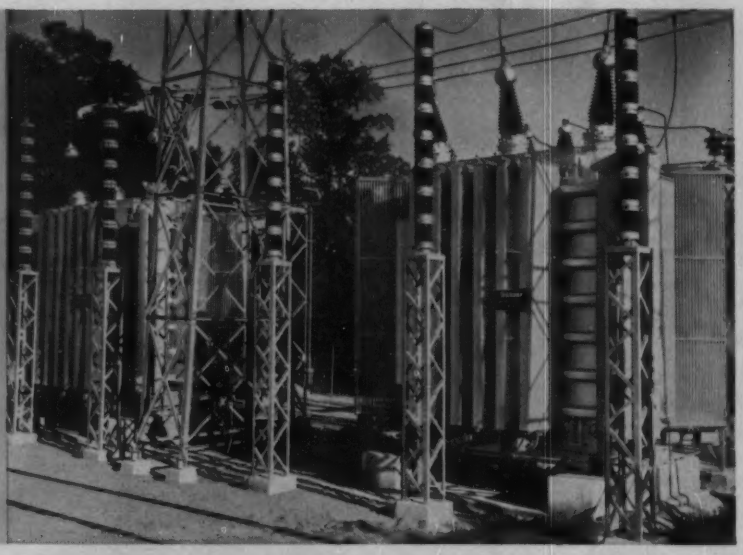
Thus, the Type WAG offers the advantages that engineers recognize as so important: a switch easy to operate, higher contact pressure, and wider contact deflection. The Type WAG has the muscle to break up heavy concentrations of ice and to operate dependably under the most adverse conditions.

For a premium quality switch capable of long, reliable service, choose the Type WAG.

SOUTHERN STATES
EQUIPMENT CORP.
HAMPTON, GEORGIA

IN CANADA: Dominion Cutout Co., Ltd., Toronto

Quality is what you get when you specify...



WAGNER POWER TRANSFORMERS

The extreme care given each Wagner Power Transformer—from inception to installation—is in keeping with Wagner's one objective . . . to build the best possible transformers that will give you years of completely dependable service.

Here are a few of the big reasons why you gain when you specify Wagner:

POWER TRANSFORMER WINDINGS, in general, are disk type for the high voltage windings and helical type for the low voltage windings—best suited to obtain rigid bracing and provide low temperature gradients throughout.

LEADS AND TAP CONNECTIONS are effectively supported for safe electrical clearance and mechanical rigidity by means of firmly positioned bakelite tubes or strong clamps on the supporting members.

TANKS are designed for strength to withstand operating pressures, with braces of heavy fabricated structural steel on the sides and ends spaced to eliminate low frequency audio noises. All seam welds are made by a fully automatic welder.

Get the whole story . . . write for Bulletin TU-16D or better yet, ask your nearby Wagner branch to show you Wagner's sound-color movie: "Transformers in the Making."

Wagner Electric Corporation

6456 PLYMOUTH AVENUE, ST. LOUIS 14, MISSOURI

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

THESE SIX SMALL DETAILS ADD UP TO BETTER PERFORMANCE — EASIER MAINTENANCE

DEEP, PENETRATING WELDS. Submerged electric-arc melt welds penetrate deeply, are exceptionally smooth and uniform. Inspectors say, "the best welds made anywhere."

LEAK-PROOF MOUNTING BOSS. For thermometer wells, relay wells and radiator drain plugs. Serrated surfaces make annular grooves in the annealed copper gasket to form leak-proof joint.

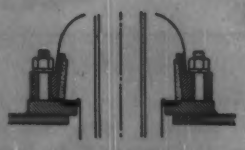
LIQUID ACTUATED THERMOMETERS. Much more accurate and dependable than thermometers that are actuated by a coiled bimetal strip.

VACUUM-PRESSURE BLEEDER VALVE. Has large diameter diaphragms to actuate the valve mechanism when pressure or vacuum inside tank becomes too great. Located on the outside of sealed units for your convenience.

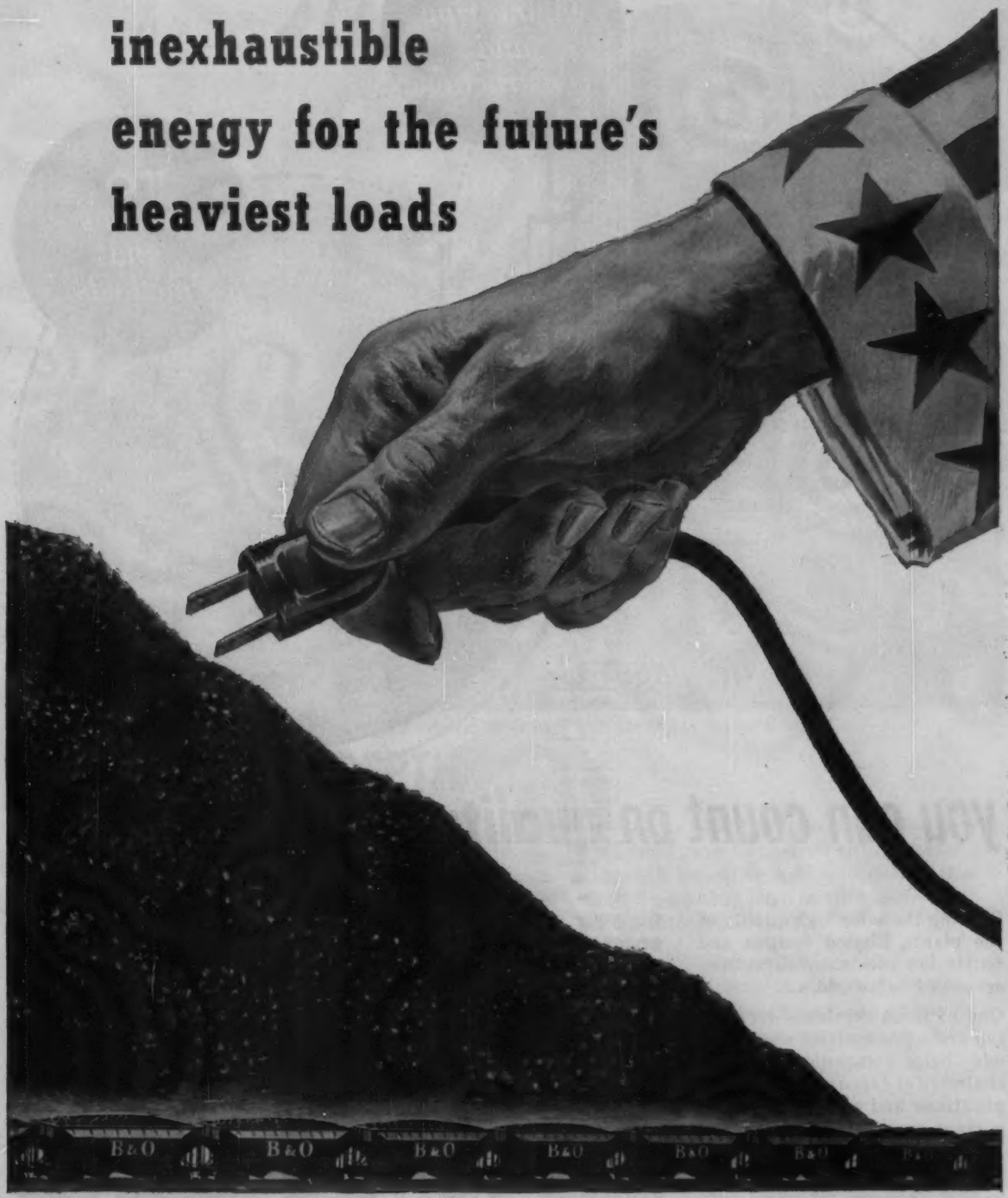
DRAIN VALVES THAT DRAIN *ALL* THE OIL. This 2" bolted-on drain valve, with auxiliary oil sampling valve, will drain the tank completely. Used on ASA standard rated transformers.

T37-15A

LEAK-PROOF BUSHING JOINT. The gasket is compressed between the porcelain shoulder of the bushing and the tank mounting flange—easy to tighten, simple to replace. Used on transformers with voltages 15 KV and below.

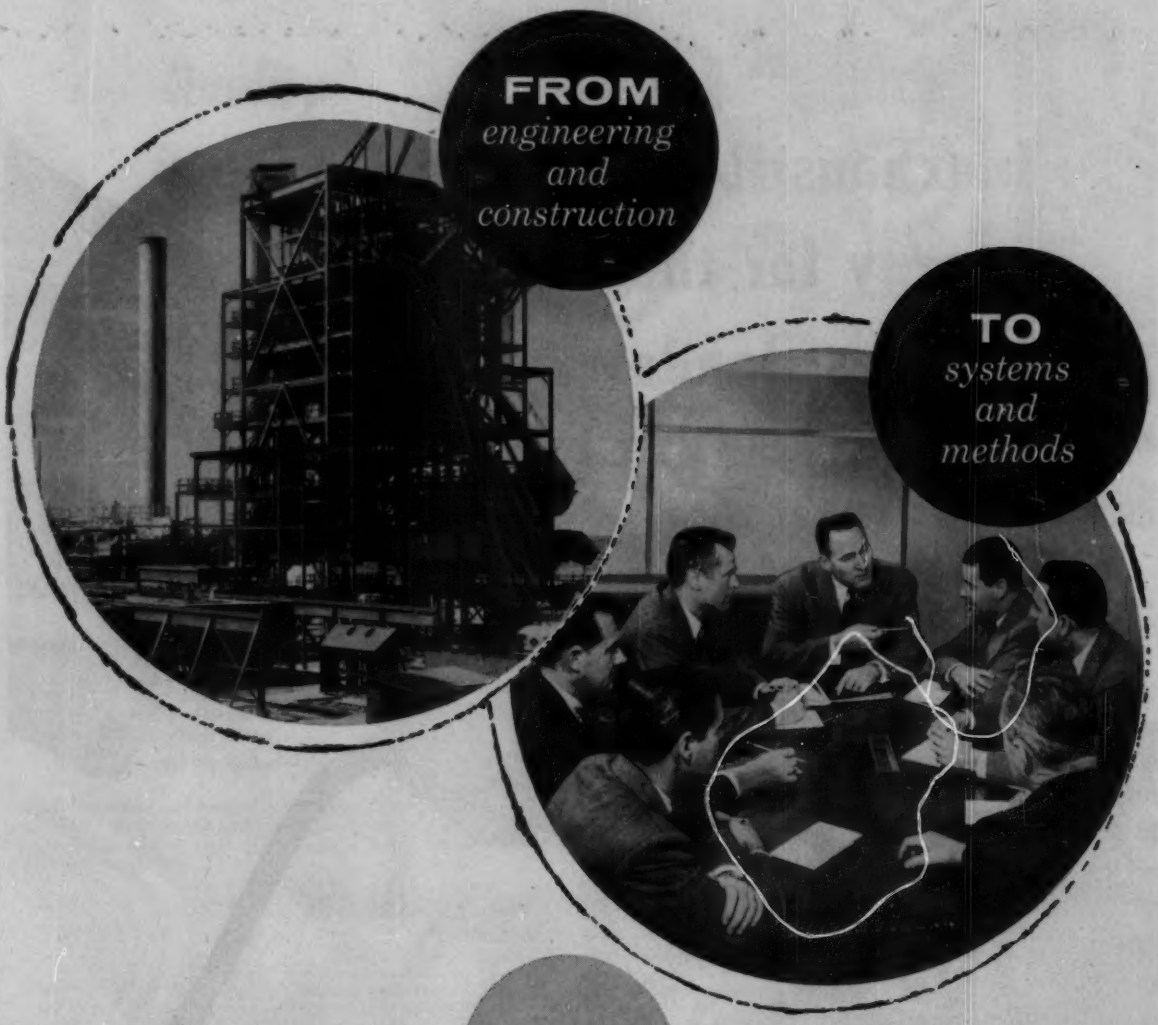


inexhaustible energy for the future's heaviest loads



B&O BITUMINOUS COALS FOR EVERY PURPOSE

Ask our man! BALTIMORE & OHIO RAILROAD—BALTIMORE 1, MD. PHONE LExington 9-0400



you can count on quality performance

Sharing the same high quality of the plants Ebasco designs and builds are the many *consulting services* Ebasco offers.

One of these services—*accounting and office systems and methods*—helps companies meet the challenge of ever-increasing complications and costs in this important area of operations. An Ebasco methods improvement program can help point the way to better service and lower costs for your company. These programs are based on years of concentrated experience with companies large and small—and backed by continual research in new methods and up-to-date machine equipment.

For more information about our accounting and office systems and methods services, write: Ebasco Services Incorporated, Systems and Methods Department, Two Rector Street, New York 6, N. Y.

Challenging career opportunities are available for qualified engineers. For further information, write to our Personnel Director.

ENGINEERS · CONSTRUCTORS
EBASCO
BUSINESS CONSULTANTS

CONSULTING ENGINEERING • DESIGN AND CONSTRUCTION • FINANCIAL AND BUSINESS STUDIES • INDUSTRIAL RELATIONS • INSURANCE, PENSIONS AND SAFETY • PURCHASING, INSPECTION AND EXPEDITING • RATES AND PRICING • RESEARCH • SALES AND PUBLIC RELATIONS • SPACE PLANNING • SYSTEMS, METHODS AND BUDGETS • TAX • VALUATION AND APPRAISAL • WASHINGTON OFFICE

NEW YORK · CHICAGO
DALLAS · PORTLAND, ORE.
SAN FRANCISCO · WASHINGTON, D. C.

R&IE AIR SWITCHES

have ALL *dimensions . . .*

DEPTH
WIDTH
HEIGHT
LENGTH

An installation of the original 1910 horn gap switch, as designed by R&IE

No. 1—DEPTH *of Experience*

BACKGROUND—that's what the founders of R&IE—and those who followed gave to modern switch design. They learned, through long-time field experience, the elements of switch design that have lasting value, also those that cause operating troubles.

The original horn-gap "Burke" switch in 1910, followed by the original hi-pressure contact, the first rotating blade, and the first sealed hinge contact, are examples of R&IE contributions.

It's this 47 years of experience that pays off in long service life of every R&IE switch, and with ingenuous answers to switch application problems.

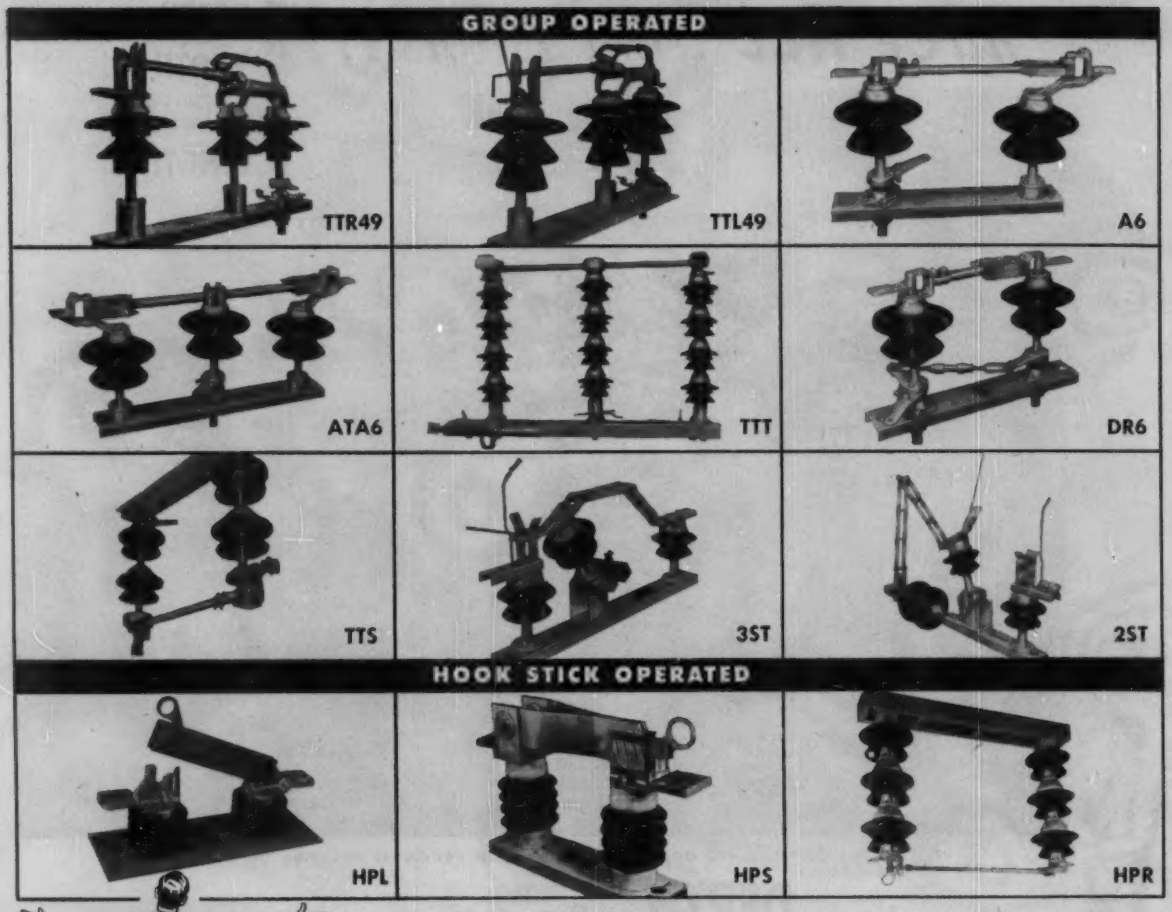
SPECIFY THE "EXPERIENCED" SWITCH!

Now note our progress . . .

1924

R&IE EQUIPMENT DIVISION
I-T-E CIRCUIT BREAKER CO.
GREENSBURG, PA.

R&IE AIR SWITCHES



No. 2—WIDTH *of Selection*

The great variety of R&IE switch types is the width dimension developed by constant evolution to meet new switching requirements.

TTR49—vertical break
TTL49—vertical break (horn-gap)
A6—side break, toggle jaw
ATA6—double side break, toggle jaw
TTT—double side break, rotating blade
DR6—center break
TTS—side break, rotating blade
3ST—3-insulator, braidless, tilting
2ST—2-insulator, braidless, tilting

TRE—vertical break, load interrupter
AE—side break, load interrupter
3STE—tilting, load interrupter
TR1—quick break arcing horn
ALTO—tap-off, quick break arcing horn
TRG—air-blast interrupter
HPL-C—arc chute interrupter
L—internal arcing interrupter
ELBD—single phase interrupter

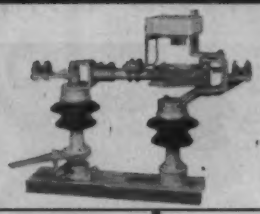
HPL—line contact, 3" bolt circle
HPS—spot contact, 3" bolt circle
HPR—special spot contact and latch, 5" bolt circle

TG—manual, grounding
TGV—high speed, vertical
TGH—high speed, side, grounding

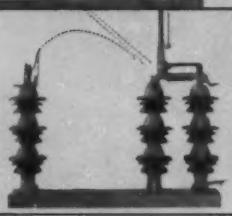
have **ALL** *dimensions . . .*

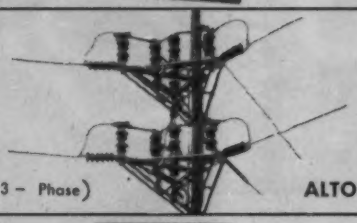
INTERRUPTING

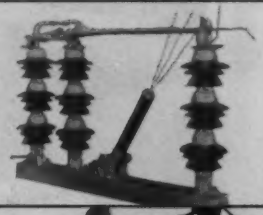
TRE


AE

3STE


TRI


(3 – Phase) ALTO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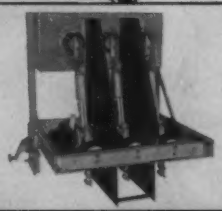
HPL-C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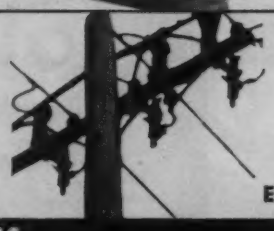
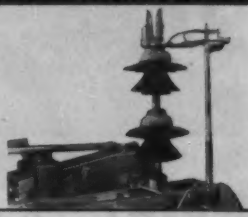
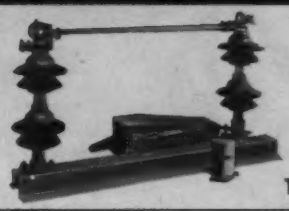
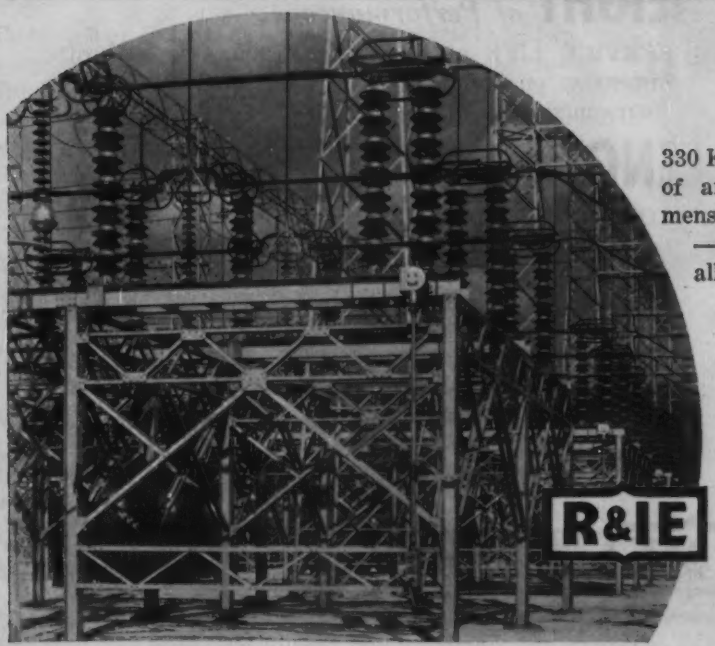

ELBD

GROUNDING—MANUAL AND AUTOMATIC

TG


TGV


TGH

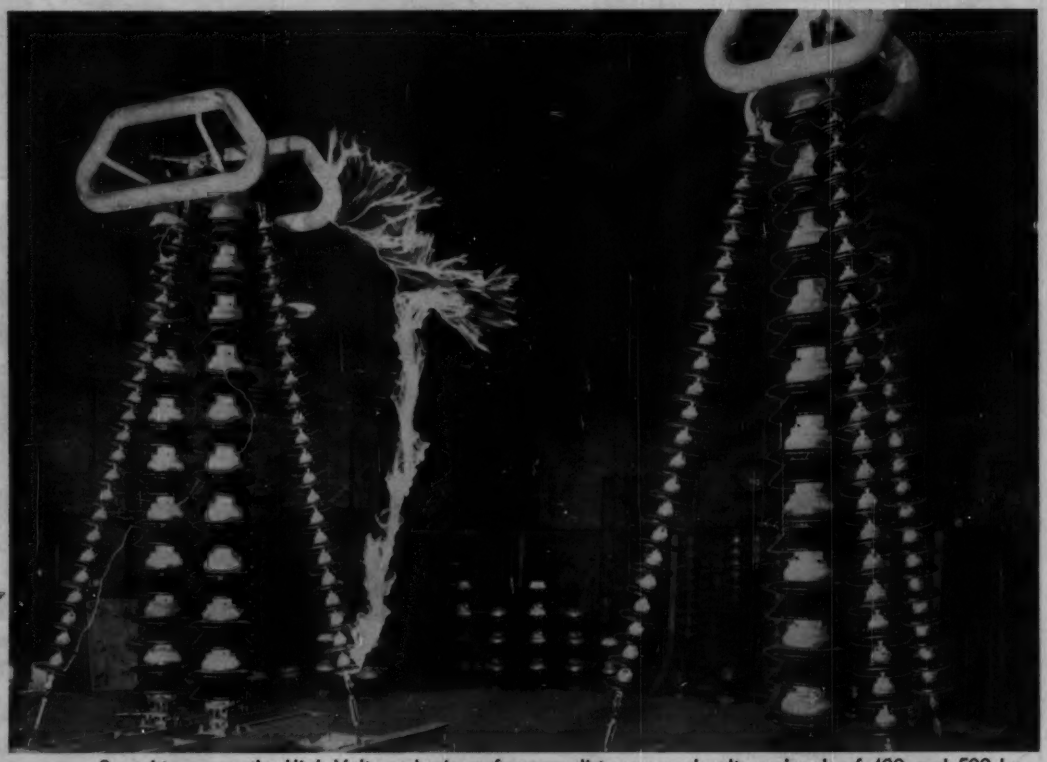


330 Kv switches are indicative of another R&IE width dimension—full voltage range —7500 volts and all the way up.

R&IE EQUIPMENT DIVISION
I-T-E CIRCUIT BREAKER CO.
GREENSBURG, PA.

R&IE AIR SWITCHES

have ALL *dimensions...*

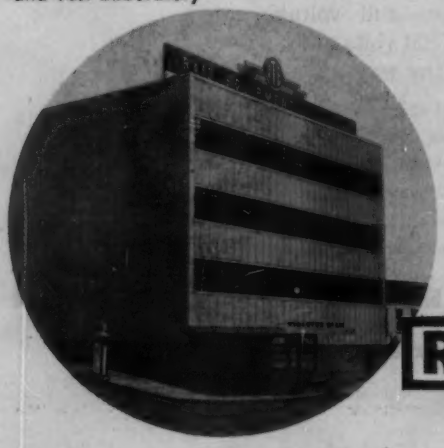


Searching, over the High Voltage horizon, for gap distances and voltage levels of 400 and 500 kv.

No. 3—HEIGHT *of Performance*

SERVICE LIFE of R&IE Air Switches is a third dimension on which you can base your confidence. Your confidence is our constant goal.

Modern R&IE Research and Test Laboratory



No. 4—LENGTH *of Research Programs*

LONG RANGE DEVELOPMENT programs continue to search for new devices and new economies. Constant improvement in switch details, and switching applications, is the kind of "vision-eering" that reaches for your problems of tomorrow. Call on your I-T-E representative for technical assistance. He has the command of both experience and specialized service to help you solve those problems.

The Margin of Quality Distinguishes R&IE Products

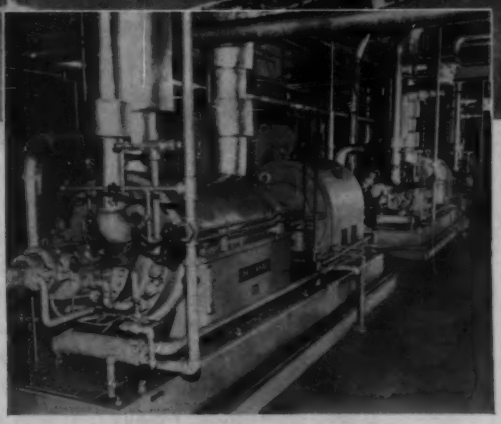
R&IE

R&IE EQUIPMENT DIVISION
I-T-E CIRCUIT BREAKER CO.
GREENSBURG, PA.

Modern central stations use

DE LAVAL

BARREL TYPE BOILER FEED PUMPS



Three ten-stage De Laval high pressure, barrel type boiler feed pumps, are on the line at the Deepwater Station of the Atlantic City Electric Company. Shown above is an aerial view of this station located in Penns Grove, New Jersey at the southern end of the Jersey Turnpike. Each pump delivers 675 gpm to the boiler for a total flow of 685,000 pounds per hour. Each pump operates at 1762 psi with temperature at 287 F., and is driven by a 900 hp motor.

When it came time to modernize one of their existing facilities, Atlantic City Electric Company and Gibbs & Hill, Inc., consulting engineers, chose two similar De Laval pumps to serve a new 79,000 kw generator.

IMO Pumps For Fuel Oil Service

Also doing an important job in this Atlantic City Electric Company station are De Laval IMO screw-type positive displacement pumps. They supply fuel oil to the burners round the clock.

Send for De Laval Bulletin 1506, which contains helpful data.

DE LAVAL *Boiler Feed Pumps*

DE LAVAL STEAM TURBINE COMPANY

861 Nottingham Way, Trenton 2, New Jersey

which BUS CONDUCTOR carries 20% more current?

CHASE VENTILATED SQUARE COPPER TUBE BUS

Twenty per cent more current just naturally flows through Chase ventilated square bus! Convection-cooling reduces operating temperatures so conductivity is kept at a maximum—twenty per cent higher current than ordinary unventilated bus! Chase square bus is tops in structural rigidity and ease of jointing, too. Full information about this heavyweight champ and other Chase buses is yours, FREE. Send for Chase's bus conductor booklet.

Chase®
BRASS & COPPER CO.
WATERBURY 20, CONNECTICUT
SUBSIDIARY OF KENNECOTT COPPER CORPORATION

The Nation's Headquarters for Brass, Copper and Stainless Steel

Atlanta Baltimore Boston Charlotte Chicago Cincinnati Cleveland Dallas Denver Detroit Grand Rapids Houston Indianapolis Kansas City, Mo. Los Angeles Milwaukee Minneapolis Newark New Orleans New York Philadelphia Pittsburgh Providence Rochester St. Louis San Francisco Seattle Waterbury

CHASE ELECTRICAL CONDUCTORS
are available in a variety of shapes to suit every power-carrying need.

SQUARE TUBES | ROUND TUBES | CHANNELS | ANGLES | BARS | CABLES

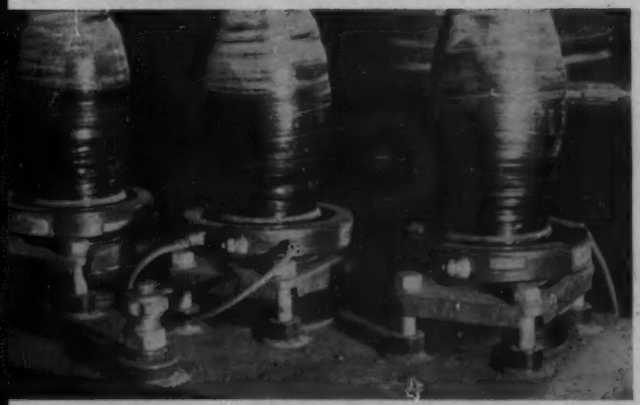
Want low-cost accurate measurement of network system loads?

Lincoln Type AD-6 thermally lagged ampere demand meters indicate loading of transformer and show maximum demand reached.

NEW Sangamo Combination provides permanent installation for continuous demand measurement at a cost of $31.35 per phase*

Now you can obtain continuous measurement of loading of network transformers with the simple, inexpensive installation of Lincoln Type CC split-core Transformers and AD-6 ampere demand Meters. The CC Transformer consists of two identical "C" shaped wound cores, which bolt together around the bushing of your network protector—without service interruption. They connect to adjacent meter sockets. When AD-6 Meters are plugged into these sockets they continuously measure the loading of the transformer and leave an indication of the maximum demand reached. When a more detailed study of loading conditions is required the AD-6 meter can be temporarily replaced with a portable graphic ampere demand meter (Lincoln Type CCA-6) which charts a continuous record of demand. Ask your Sangamo representative, or write for information.

*Cost of CC Transformer and AD-6 Meter.



These Lincoln Type CC split-core Transformers, bolted together around the bushings or cables of a network protector, are connected to adjacent meter sockets. Available in ratings of 1500, 2000, 2500 and 3000 amperes.

SM57-6

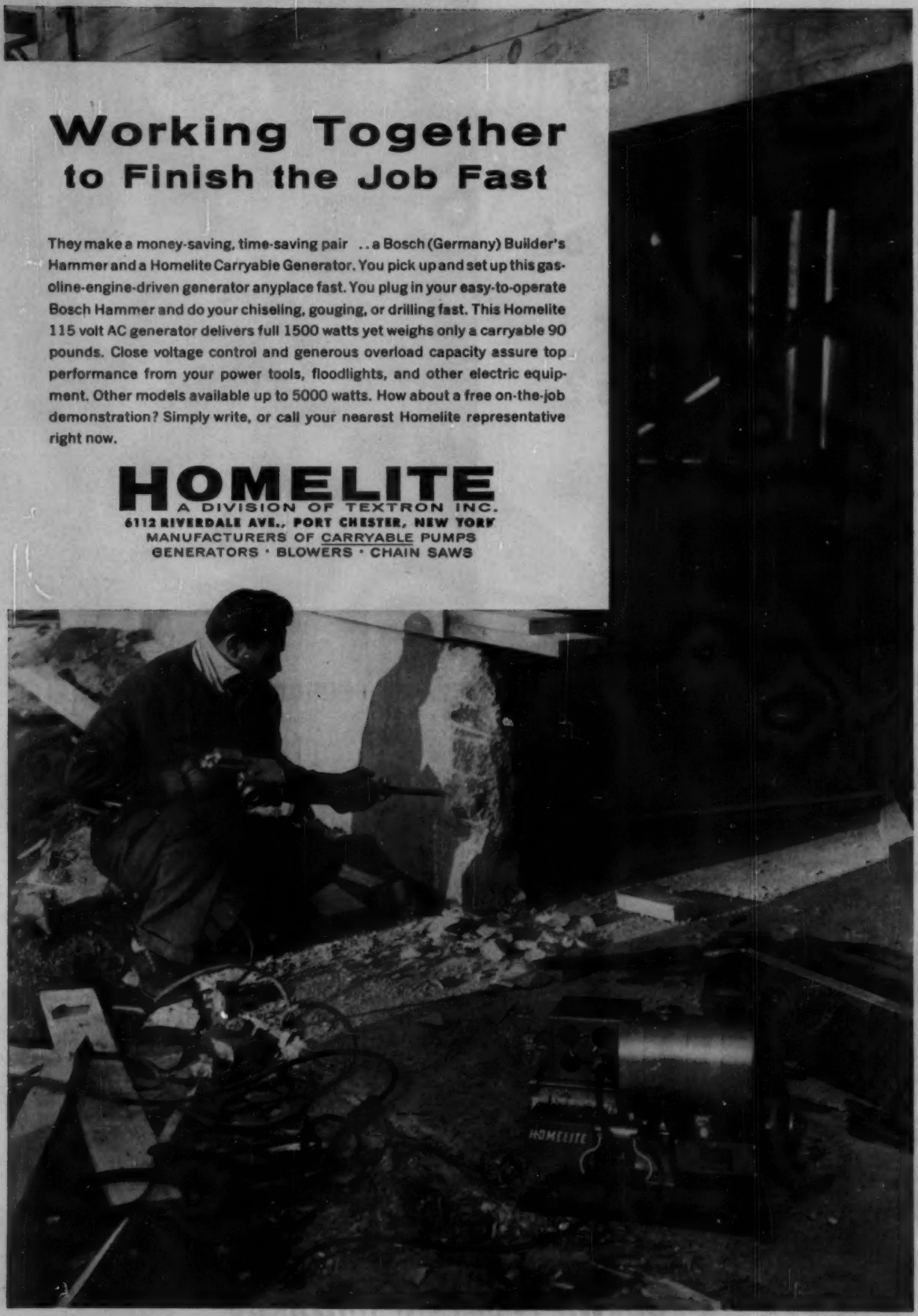
SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

Working Together
to Finish the Job Fast

They make a money-saving, time-saving pair . . a Bosch (Germany) Builder's Hammer and a Homelite Carryable Generator. You pick up and set up this gasoline-engine-driven generator anyplace fast. You plug in your easy-to-operate Bosch Hammer and do your chiseling, gouging, or drilling fast. This Homelite 115 volt AC generator delivers full 1500 watts yet weighs only a carryable 90 pounds. Close voltage control and generous overload capacity assure top performance from your power tools, floodlights, and other electric equipment. Other models available up to 5000 watts. How about a free on-the-job demonstration? Simply write, or call your nearest Homelite representative right now.

HOMELITE
A DIVISION OF TEXTRON INC.
6112 RIVERDALE AVE., PORT CHESTER, NEW YORK
MANUFACTURERS OF CARRYABLE PUMPS
GENERATORS · BLOWERS · CHAIN SAWS



A. B. CHANCE CO.

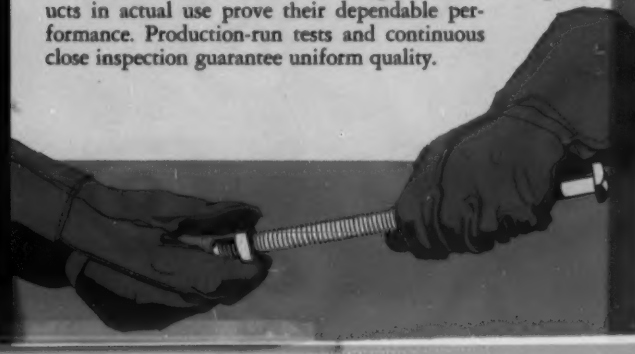
POLE LINE HARDWARE

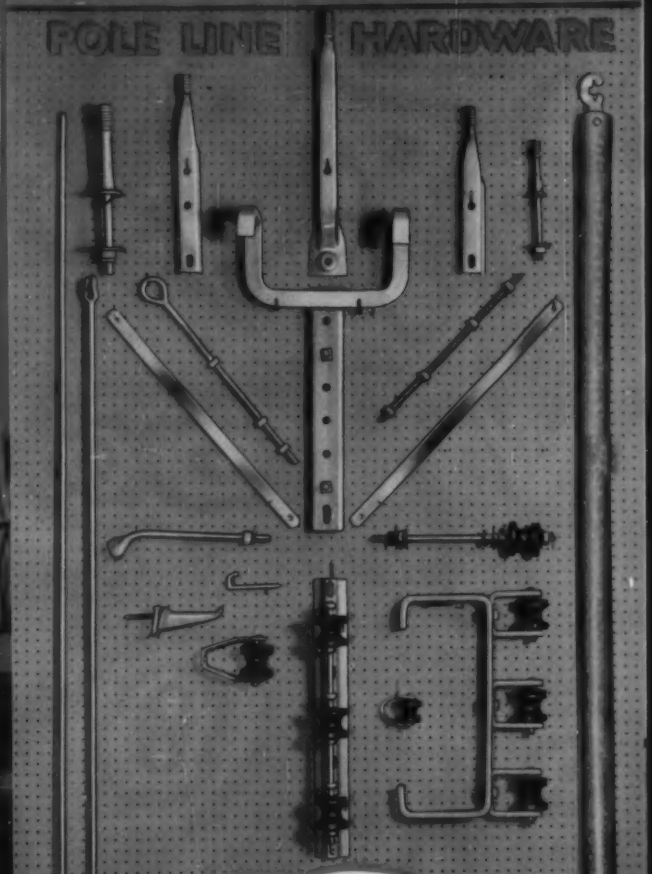
FIELD ENGINEERED TO MEET TODAY'S CONSTRUCTION NEEDS

Continuous field research by Chance Engineers in the development of anchors, guying materials, protective devices and switchgear is now being applied to Pole Line Hardware, newest addition to Chance's product lines. Out in the field, Chance Engineers get first-hand knowledge of modern line construction needs. Combining this knowledge with laboratory development and product testing techniques, Chance is able to offer improved products specifically designed to meet your pole line hardware requirements.

QUALITY CONTROLLED TO MEET OR EXCEED ALL INDUSTRY SPECIFICATIONS

A plant-wide checking and inspection system controls the quality of all Chance Pole Line Hardware. Products are subjected to much more severe conditions in laboratory tests than would be encountered in the field, so that adequate safety factors can be built into Chance designs. Field tests of products in actual use prove their dependable performance. Production-run tests and continuous close inspection guarantee uniform quality.





"...and you can get CHANCE HARDWARE locally—from your line equipment wholesaler"

JACK CURTRIGHT,
Sales Manager,
Wholesaler Products,
A. B. Chance Company

Serving the Utility Industries since 1907

50 YEARS ANNIVERSARY
A. B. CHANCE COMPANY

FIELD ENGINEERED TO MEET TODAY'S CONSTRUCTION NEEDS

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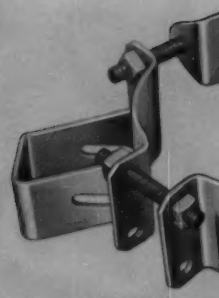
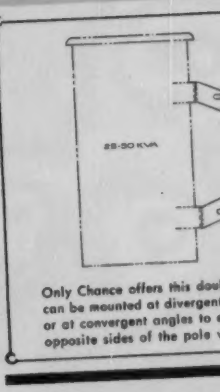


TRANSFORMER CLUSTER MOUNTING BRACKETS



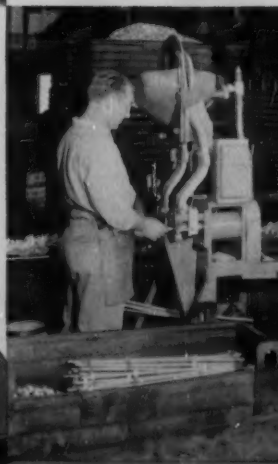
Only Chance offers this dou
can be mounted at divergent
or at convergent angles to
opposite sides of the pole

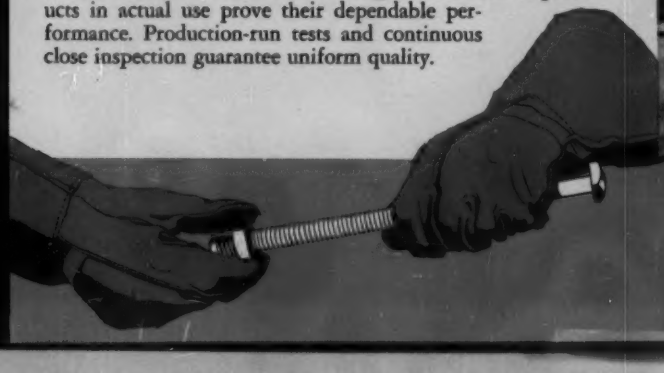
GET FAS
CUT IN
SUPPORT YOU

For prom
the phon
from yo

QUALITY CONTROLLED TO MEET OR EXCEED ALL INDUSTRY SPECIFICATIONS

A plant-wide checking and inspection system controls the quality of all Chance Pole Line Hardware. Products are subjected to much more severe conditions in laboratory tests than would be encountered in the field, so that adequate safety factors can be built into Chance designs. Field tests of products in actual use prove their dependable performance. Production-run tests and continuous close inspection guarantee uniform quality.





QUALITY CONTROL IN
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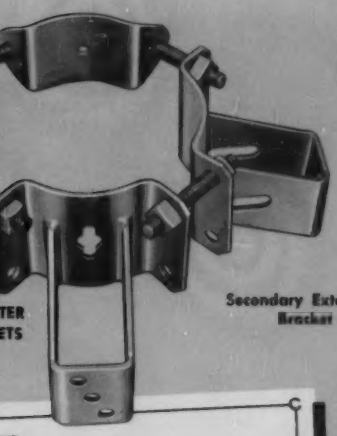
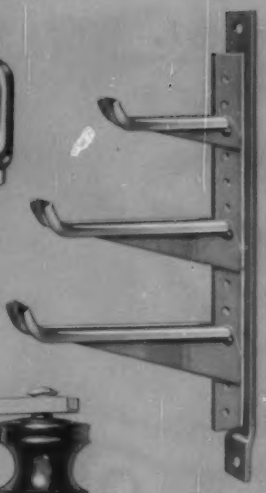


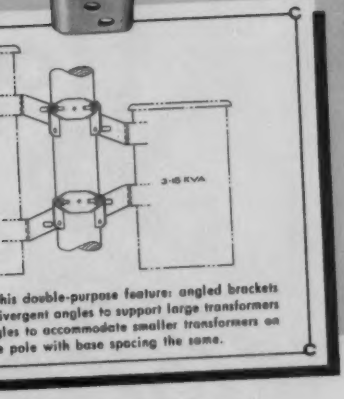
Secondary Extension Bracket

Wireholder

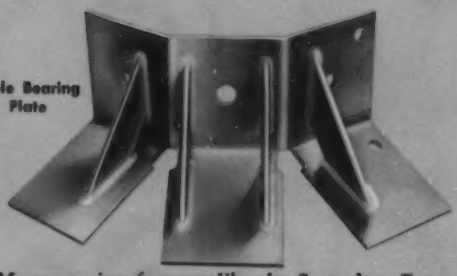


Underground Cable Racks and Hooks

Insulated Clevis



his double-purpose feature: angled brackets ivergent angles to support large transformers gles to accommodate smaller transformers on e pole with base spacing the same.



Pole Bearing Plate

Money saving features like the Secondary Extension Bracket that eliminates separate extensions ... stronger, easier-to-use designs like the Chance Insulated Clevis, Wireholder, and Underground Cable Racks and Hooks ... and brand new items like the Pole Bearing Plate (used in pairs) that prevents poles from "working up" out of the ground, are only a few of the many reasons it's to your advantage to specify CHANCE for Pole Line Hardware!

FAST DELIVERY INVENTORY OUR LOCAL SUPPLIER

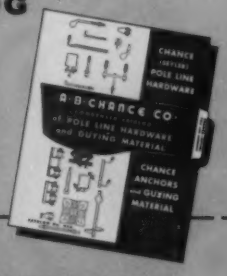
r prompt delivery—for better service—just pick up e phone and order Chance Pole Line Hardware om your local supplier. Keep him informed of your requirements so he can carry the necessary stock, and you can order in quantities most economical for your operations. BE SURE TO SPECIFY CHANCE.

OL IN ACTION: Chance Pole Line Hardecked for pre-fit by these automatic that detect and reject misfits—an exion control to eliminate field difficul-

FIND IT QUICKLY

IN THIS CONDENSED CHANCE CATALOG

Get this ready reference for everything you need in pole line hardware. A combination catalog and file folder — arranged to help you find what you want quickly and easily.



A. B. CHANCE CO.
Centralia, Missouri

Please send me the Chance condensed POLE LINE HARDWARE and GUYING MATERIAL CATALOG ... also special information on these NEW items:

- ☐ TRANSFORMER MOUNTING BRACKETS
- ☐ SECONDARY EXTENSION BRACKETS
- ☐ POLE BEARING PLATES

Name_____

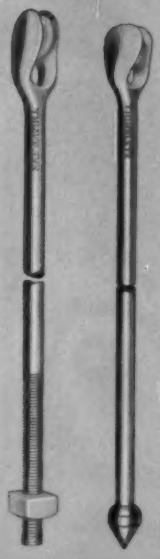
Company_____

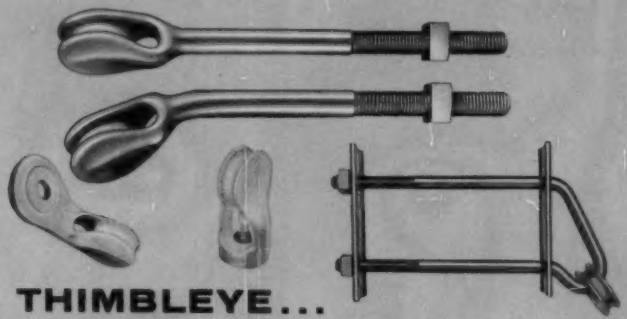
Address_____

City & State_____

Name of Preferred Supplier_____

for a real good GUY... always use
CHANCE GUYING EQUIPMENT





THIMBLEYE...
a Chance contribution to BETTER GUYING

Chance Guy Fixtures and Anchor Rods with full-rounded Thimbleyes, Twineyes or Tripleyes (originally designed by Chance) give complete strand protection and simplify guy attachments. Drop forged from high grade steel—heavily galvanized. Always top quality when you specify Chance.

Flanged hook slips over the guy wire. No stretching for high bolts. Hook holds guard away from strand to eliminate noisy vibration.

and finish the job with the

New CHANCE 808

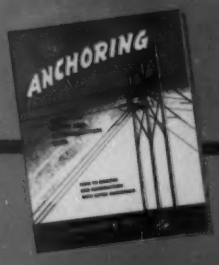
GUY GUARD

ECONOMICAL IN COST
The new Chance 808 Guy Guard is a general-purpose, inexpensive guard designed for economy in first costs—in labor costs—in long life.

EASY TO INSTALL
The 808 hooks easily over the guy strand—fastens with a single nut. Only one wrench is needed.

GIVES LASTING PROTECTION
The 808 has no sharp edges to endanger the public. Edges are turned in for rigidity and safety. Heavy gauge steel guard is hot galvanized for long life and high visibility.

Single bolt at lower end of guard fastens three ways: to guy rod . . . to guy wire . . . to guy loop. You get proper installation every time.



GET THIS BOOKLET. It's the most complete guide to anchoring ever developed . . . full of how-to-do-it material to help you select the right anchor for every job—and install it properly. It's FREE!

CP57-5

A·B·CHANCE CO·

GENERAL OFFICES: CENTRALIA, MISSOURI

ABC INDUSTRIES

REGULATORS

FOR ALL TYPES OF ELECTRIC ARC FURNACES & POWER GENERATING EQUIPMENT

High speed "Simplex" or "Transex" systems of electro-mechanical or of magnetic amplifier design.

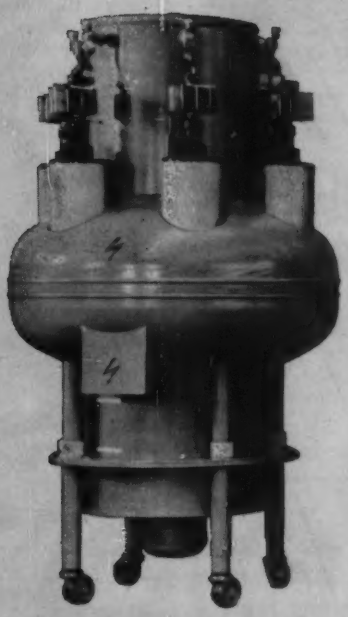
The Transex regulator has no moving parts—**NO POSSIBILITY OF MECHANICAL FAILURE.**

Ultra high speed "HF" system of electro-hydraulic design.

High speed of response, rugged and simple construction allows trouble-free and reliable operation, a high degree of uniformity and purity of the refined product.

Low installation and maintenance cost. Complete installations or components only furnished, depending on specific requirements.

Sécheron
GENÈVE



Type A615 six anode unit — 1500 A max. rated current up to 850 VDC

pumpless, air-cooled steel tank

RECTIFIERS

Available in nominal currents from 400 to 1500 A per unit. Six anode pumpless steel tanks, **forced air cooled construction.** Non-aging electrode inlets with metal-glass-ceramic "welds" unaltered by temperature changes insure **UNLIMITED PERMANENT VACUUM.** Mercury vapor and rare gas filling allowing quick start-up under full load. Small space requirements, simple erection, low maintenance costs, low initial installation costs. **No water cooling required.** Units can be connected in parallel for any output required. Complete installations can be supplied including AC and DC switchgear, 6-phase transformers, voltage regulation and unit supervisory controls.

SECHERON WORKS CO. EW
A. S. Girard, Engineering and Sales Consultant
250 Park Avenue, New York 17, N. Y.

Please send me your technical bulletins and complete information on REGULATORS ..... ☐ RECTIFIERS ..... ☐

Other Secheron Products { Power Transformers ..... ☐ Generators ..... ☐

NAME.....

COMPANY.....

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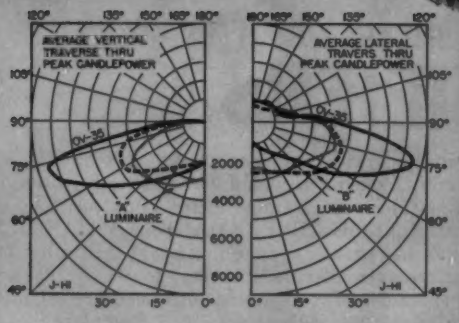
CITY.....STATE.....

2 to 3 TIMES MORE LIGHT—at
with Westinghouse, Advanced-

OV-35



See how OV-35 produces "practically twice" the candlepower of luminaires not designed specifically for fluorescent mercury lamps!

OV-35 candlepower curve is from J-H1 400 W color-improved lamp (OV-35 also utilizes B-H17 430W and B-H18 700 W lamps). Note how curves for A and B luminaires (designed *only* for *plain* mercury lamps) show *"practically half" the candlepower* when tested with the *identical lamp employed to produce the OV-35 curve!*

NO APPRECIABLE INCREASED COST!-
type MERCURY LUMINAIRES!

OV-35 **THE ONLY "Mainstreet" Luminaire Engineered and Designed Specifically for color-improved Fluorescent Mercury Lamps!**

"Mainstreet" lighting is now accomplished at *new peaks* of lighting efficiency! Yet at *negligible, if any,* increased operating cost!

This is due to exclusive Westinghouse developments now permitting OV-35 Luminaires to deliver *full* advantage of *color-improved Mercury lamps!*

It's well-known that *mercury* light-sources give up to *three times more light per watt* (than old-fashioned light-sources)! And also *out-last* old-style lamps by as much as *seven times!*

So, now Westinghouse, *alone,* has engineered the OV-35 Luminaire *specifically for* these superior mercury lamps—the OV-35, featuring an *exclusive, sealed* optical system, that *keeps out* bugs and water—and delivers this *greater* illumination, with *unparalleled* efficiency, *directly onto the road-way!*

This OV-35 has a housing of cast aluminum—a special glass refractor of *custom prismatic* design!—a reflector of Alzak Processed drawn aluminum.

Its slip-fitter provides quick, easy mounting and adjustable alignment. Its automatic latch permits fast, "one-hand" maintenance. Yet the seal is *tight* on *special* gaskets! The OV-35 is moisture-*proof* and bug-*proof!* This OV-35 *itself* is accredited for *many* of the advancements in modern "mainstreet" lighting today!

OV-10 **Now Brings the Same, Ideal-type Illumination to Residential Streets!**

The OV-10 has been engineered identically, to complement the famed Mercury Lighting Line of Westinghouse OV Luminaires, *preferred* by *most* street-lighting engineers!

The OV-10 delivers the same "*2-to-3-times-more-light*" and the *same* extraordinary *economy* for the proper lighting levels of *secondary streets!*

The OV-10 utilizes L-H4 100 W, A-H22 175 W and C-H5 250 W lamps. It has, in general, the same marked design and construction superiorities of all Westinghouse street-lighting luminaires. One simple move of the socket gives a choice of light-distribution to suit illumination requirements for virtually *any* secondary street!

All Westinghouse OV Luminaires are available now!

through your near-by Westinghouse Representative, or your own local Westinghouse Distributor! J-04423

WESTINGHOUSE LEADS ALL OTHERS IN THE ENGINEERING, DESIGN AND DEVELOPMENT OF MERCURY ILLUMINATION FOR ALL ROADWAY LIGHTING APPLICATIONS!

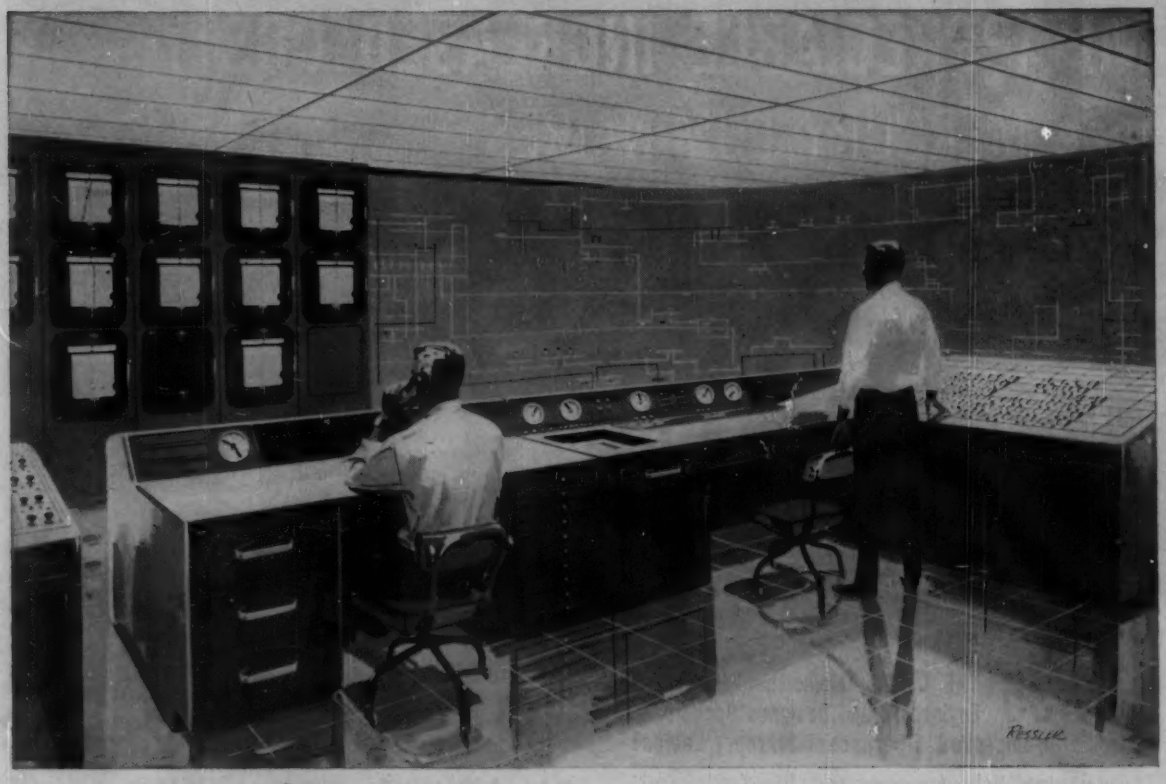
YOU CAN BE SURE...IF IT'S

Westinghouse

OV-20 LUMINAIRE (E-H1 & J-H1 400W; A-H24 & B-H24 430W lamps)

OV-80 LUMINAIRE (A-H18 & B-H18 700W; A-H15 & B-H15 1000W lamps)

Another L&N solution to the area regulating problem



Miami Dispatcher's Office prepares for closed-loop operation on incremental cost-of-delivered power basis. They've ordered . . .

New "Desired Generation" Computer to integrate with present Florida Power & Light Area Control

Written by J. F. Springman, Leeds & Northrup Co., for this advertisement

• Because so many industries are building plants in Florida, FP&L has taken bold steps to keep up with an astonishing load growth: generating capability has more than quadrupled since World War II. Not content with the addition of 800,000 kw in that period, FP&L's operating people have given the green light for installation of the most advanced operating tool—a transistorized Desired Generation Computer.

A True Computer

Not only will the new computer mastermind automatic control of 19 units in all eight major plants, but it also can be used to solve complex load problems as an independent unit when disconnected from the control system. During the time the computer is used for other problems the control continues under the direction of the present equipment. When performing its control function, the computer will coordinate incremental transmission and generating costs using incremental heat rate, fuel cost and performance factor data. It will also be used to determine economic dispatch of 24 units—97 per cent of system capability. As a result, FP&L's already advanced Area Control will be boosted to a technological level exceeded by no other utility in the world.

Noteworthy Prediction

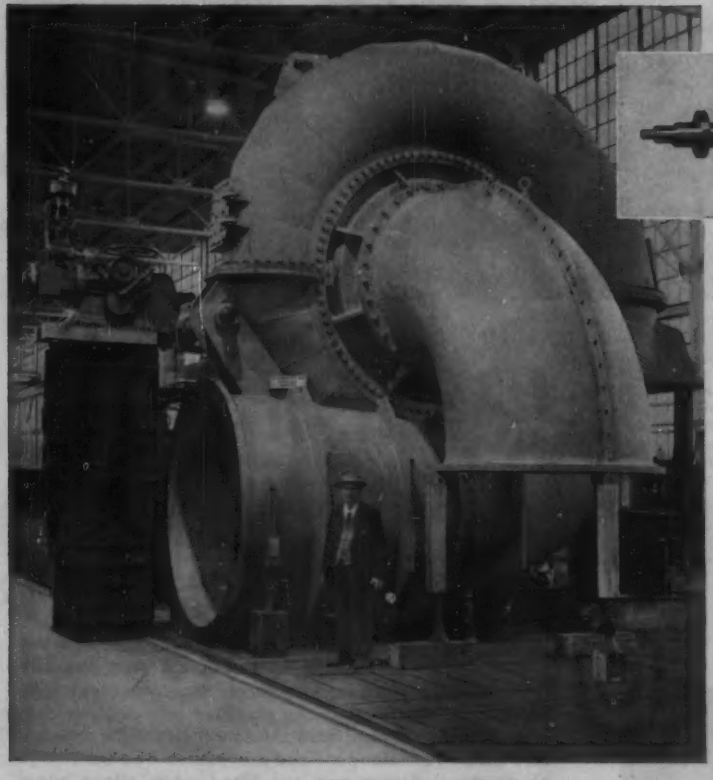
A 1948 board study of the FP&L system formed the basis of an AIEE paper* co-authored by FP&L's Manager of Power Supply, H. W. Page. This paper helped pave the way for development of dispatch computers

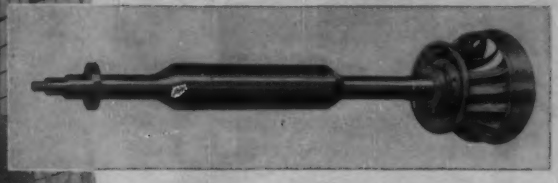
**AIEE Transactions T9242 "Coordination of Fuel Cost and Transmission Loss by Use of the Network Analyzer to Determine Plant Loading Schedules" by E. E. George, H. W. Page and J. B. Ward.*

Continued on page 146

LEFFEL BUILDS GIANT HORIZONTAL TURBINE FOR PLEASANT VALLEY

The low net head of 68 ft. at the Pleasant Valley Power Plant near Los Angeles required the design and construction by Leffel of a giant, horizontal spiral case turbine unit. This turbine, rated to develop 3,520 H.P. under the net head of 68 ft. at a speed of 257 R.P.M., drives a horizontal generator. A common shaft carries both the generator rotor and the stainless steel runner. A synchronous by-pass valve allows adjustment of flow for both turbine and by-pass discharge to meet water passage requirements. Photographs here show this giant turbine in various stages of production at the modern Leffel plant.





Leffel has the technical know-how and modern plant facilities to design and construct efficient, economical, rugged turbines of most types and capacities. And Leffel provides fast, complete service. Field engineers are available to assist you in the original planning of your project, and to help you with the actual installation of your turbine.

If you're planning a new project, or the rehabilitation or expansion of old facilities, and you want fast, complete service, contact Leffel, producers of top performing turbines. Mail the coupon below, today, for complete information.

LEFFEL HELPS YOU PRODUCE MORE POWER FOR PROGRESS

1102-E

THE JAMES LEFFEL & CO.

FOUNDED IN 1862

MORE EFFICIENT HYDRAULIC POWER FOR 95 YEARS

FREE LITERATURE

THE JAMES LEFFEL & COMPANY
Dept. P SPRINGFIELD, OHIO

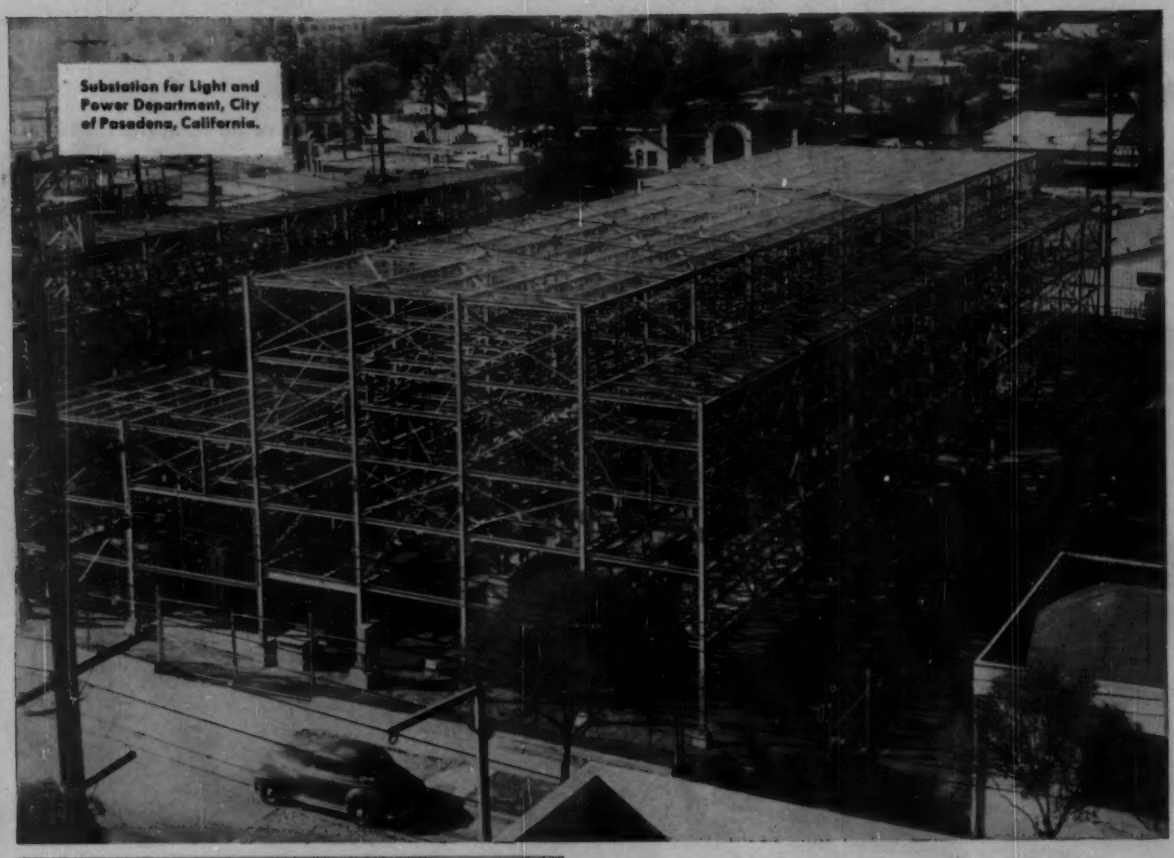
☐ Please send me more information on Leffel hydraulic turbines.

☐ Please have your representative call.

Name_____ Title_____

Company_____

Street_____ City_____ State_____



Substation for Light and Power Department, City of Pasadena, California.

13.2 KV/240 volt transformer substation for Mayville Metal Products Company, Mayville, Wis.

LARGE or SMALL

All 3E Substations get personalized design.

Custom design . . . Not customary equipment is the key to high efficiency at low cost. Substations designed specifically for the job are in close accordance with ideal engineering practice. They deliver maximum service at minimum cost and are free from hazardous short cuts or the unnecessary costs due to standardized procedures. 3E's knowledge of structural design and pre-fitted parts allows rapid erection at low labor costs and lengthens service life.

The advantages of personalized service . . . With 47 years experience concentrated on substation and switchgear, 3E's engineering staff is ideally suited to help you get the best design and equipment for your needs.

Whether you invite bids from a rough sketch or complete specs, 3E can offer a complete service, a fine design staff, a full line of indoor and outdoor switchgear and a modern plant capable of a wide range of custom fabrication.

3E

ELECTRICAL ENGINEERS EQUIPMENT CO., MELROSE PARK, ILL.
Representatives in principal cities

IMPORTANT NEWS TO UTILITY EXECUTIVES

A significant new appliance that will help level the peaks of your residential loads.

REVOLUTIONARY FEDDERS HEAT PUMP AIR CONDITIONERS

Now Being Produced in Volume and Merchandised Coast-to-Coast

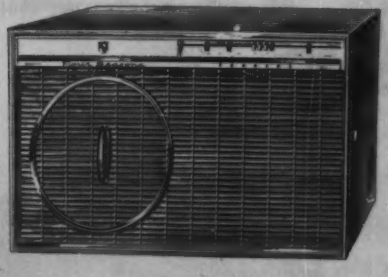
Dramatic new engineering achievements by Fedders, can help meet the problems and opportunities of the electric power industry created by the rapid growth of summer air conditioning—a *July-August peak that is bound to climb to far higher levels in the future.*

A complete line of heating and cooling window air conditioners (central units, too) is ready now to boost residential consumption on a stable year 'round basis, everywhere in the United States. Thousands of homes will enjoy *extra months of winter comfort this year . . . for the price of summer air conditioning alone.*

These engineering advances make this possible:

1. BTU/watt ratios now make electricity competitive with other heating fuels in many areas.
2. The "frost-up" problem which restricted heat pump air conditioners to warmer climates is finally solved by Fedders' WeatheRobot Automatic Defrost Cycle.
3. "Four Seasons" models for operation in any weather, anywhere in the United States, provide all-weather economy by the unique combination of heat pump action and resistance heating—down to zero degrees and below.
4. Fedders heat pump models up to 2 HP capacity are now available for every room size and every voltage requirement, 230-, 208-, and even 115-volts.

POWER FACTORS UP TO 99.9%



Now – 12 ampere 1½ HP and 7½ ampere 1-HP heat pumps operate on 115-volts. Exclusive Automatic Defrost Cycle permits operation in below freezing weather. Other models for 230 and 208-volt operation in 1-HP, 1½ HP and 2 HP capacity.

ALREADY—in these current winter months—the new Fedders Heat Pump models are being produced in volume and actively merchandised by thousands of dealers.

Eleven million families are reading about them in the current issue of Reader's Digest. Tens of millions more will learn about them in their local newspapers.

To help *your* company profit from this new load-building, load-molding appliance, mail coupon today for specification sheets, engineering data, merchandising plans and materials.

FREE "Newest way to Live Better...Electrically"

Full-color bill enclosure describes the "Newest Way to LIVE BETTER...*Electrically*" without any brand identification or specific product features.

FEDDERS-QUIGAN CORP.
Box Number EW-127
Maspeth 78, New York

Please send me full information about the New Fedders Heat Pump Air Conditioners plus a sample copy of the consumer bill enclosure entitled "Newest Way to Live Better Electrically."

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE___ STATE_____

NO AGE-HARDENING PROBLEMS!

ROEBLING TELLURIUM LEAD ALLOY SHEATH...

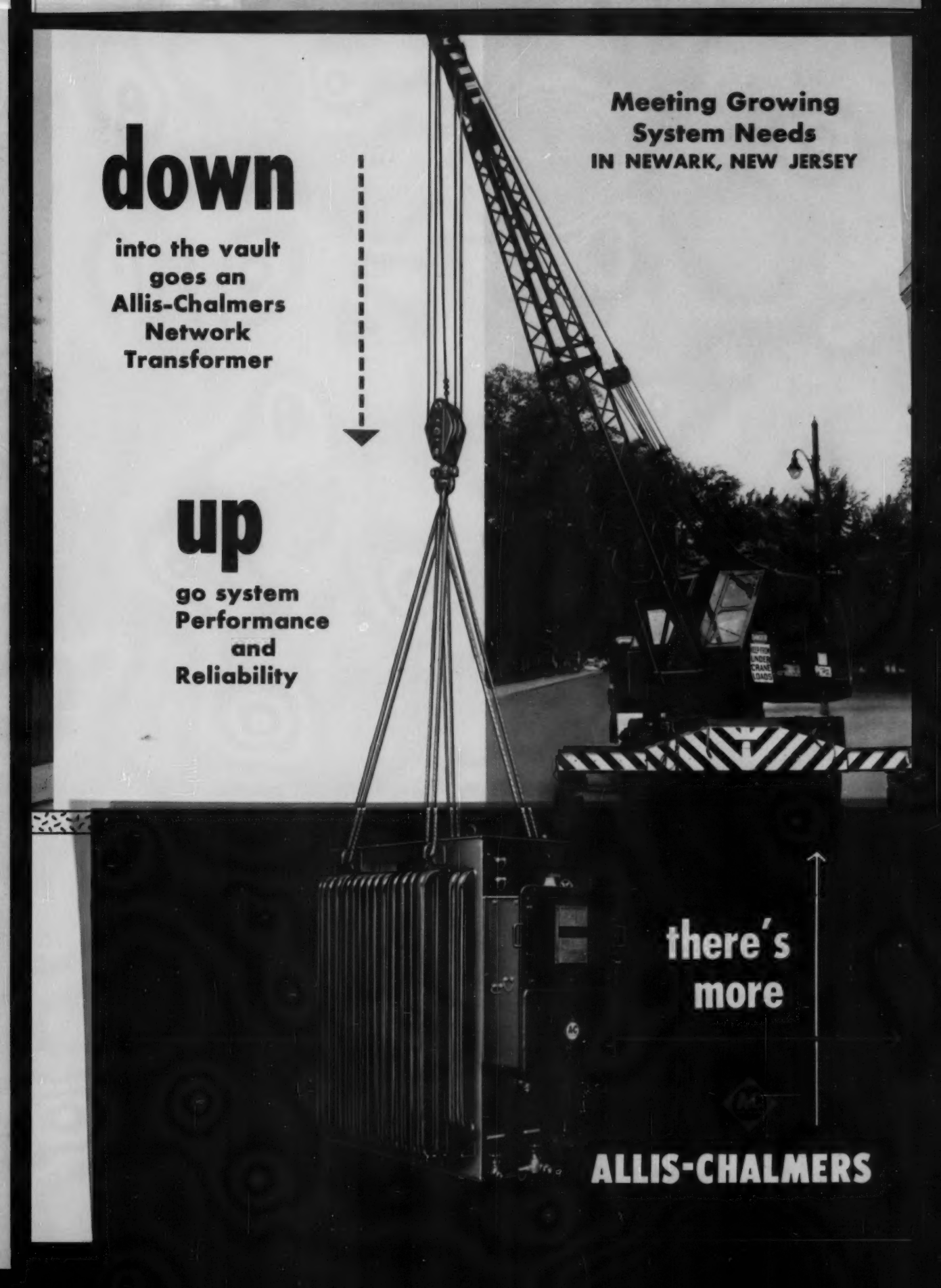
There's nothing worse to an electrical utilities system than hardening of the arteries. That's a problem eliminated by Roebling Tellurium Lead Alloy Sheath! Even after 6½ years' life (in the lab and on the job), age-hardening is negligible in this remarkable sheath. Moreover, heat stability is outstanding... bending life is 4½ times greater than that of ordinary sheath ...there's almost no "creep" at all!

The Roebling Paper Power Cable inside is built for dependability and long life, too. In fact, there's no better buy than Roebling Paper Power Cable with Tellurium Lead Alloy Sheath! An interesting technical booklet, now available, tells you exactly *why* it's such a good investment. Write for your free copy to: Electrical Wire Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

ROEBLING

Branch Offices in Principal Cities
Subsidiary of The Colorado Fuel and Iron Corporation

Roebling electrical wires and cables are available with either copper or aluminum conductors.

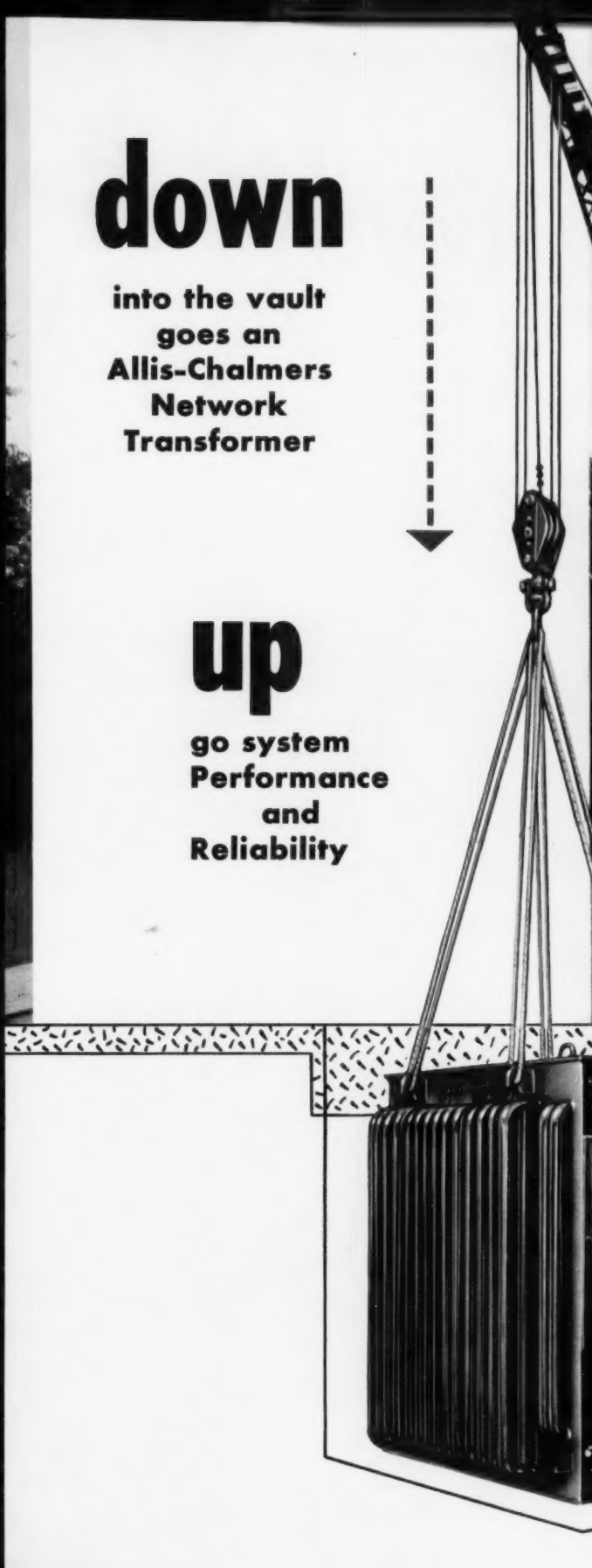

Meeting Growing
System Needs
IN NEWARK, NEW JERSEY
down
into the vault
goes an
Allis-Chalmers
Network
Transformer
up
go system
Performance
and
Reliability
there's
more
ALLIS-CHALMERS

down

into the vault goes an Allis-Chalmers Network Transformer

up

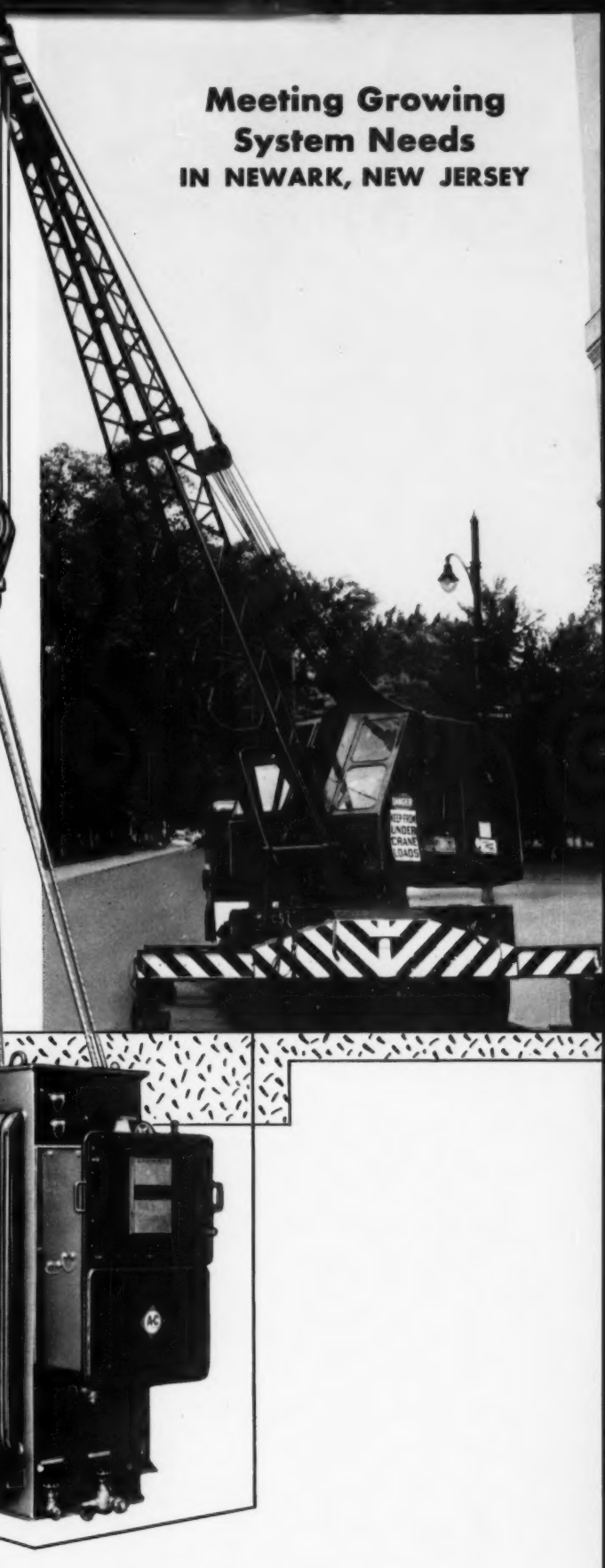
go system Performance and Reliability



ALLIS-CHALMERS NETW
The Choice of Utility

Air conditioning and other power demands are puttin a squeeze on downtown network systems in city afte city. To meet these acute load-concentration need Allis-Chalmers network transformers are being installe on many of the most important systems in the country This wide acceptance, based on an outstanding recor of performance, is your assurance of complete satisfac tion when you modernize or expand with Allis-Chalmer power equipment.

ALLIS-CH



TWORK TRANSFORMERS—
ty Engineers Everywhere

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needs,
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record
tisfac-
almers

To Meet Your Growing System Needs

It will pay you to investigate the many advantages of Allis-Chalmers network transformers . . . advantages that have merited the confidence of utilities and consultants everywhere. Get all the facts. See your Allis-Chalmers representative or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

HALMERS

A-C ALLIS-CHALMERS

A-5371

details...details...details

add Years to Transformer Life

Special Design of Bushing Seal

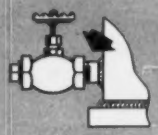
Spiral-wound metallic gaskets adjust to changing operating conditions . . . can be installed without grease or cement.

Protected Against Corrosion and Flooding

Tank surfaces are shot blasted and given three coats of baked-on phenolic base paint. Base and tubes are treated with a protective compound.

Major Gaskets Eliminated

Main cover and switch compartment are welded to tank. Oil sludging and oxidation are minimized.

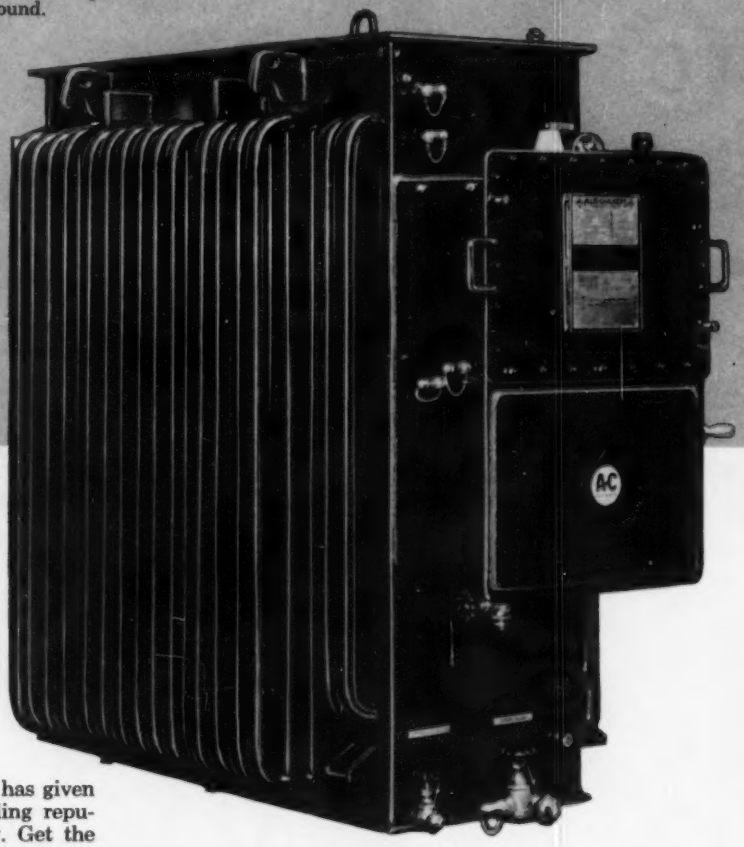


Threaded Valve Connections

Connections are solder wiped for extra protection. Valves are located for easy access. Globe-type valves with nonrotating seats close tight, avoid wear on the valve seat.

ALLIS-CHALMERS

NETWORK TRANSFORMERS



Compact, Low-Loss Design—

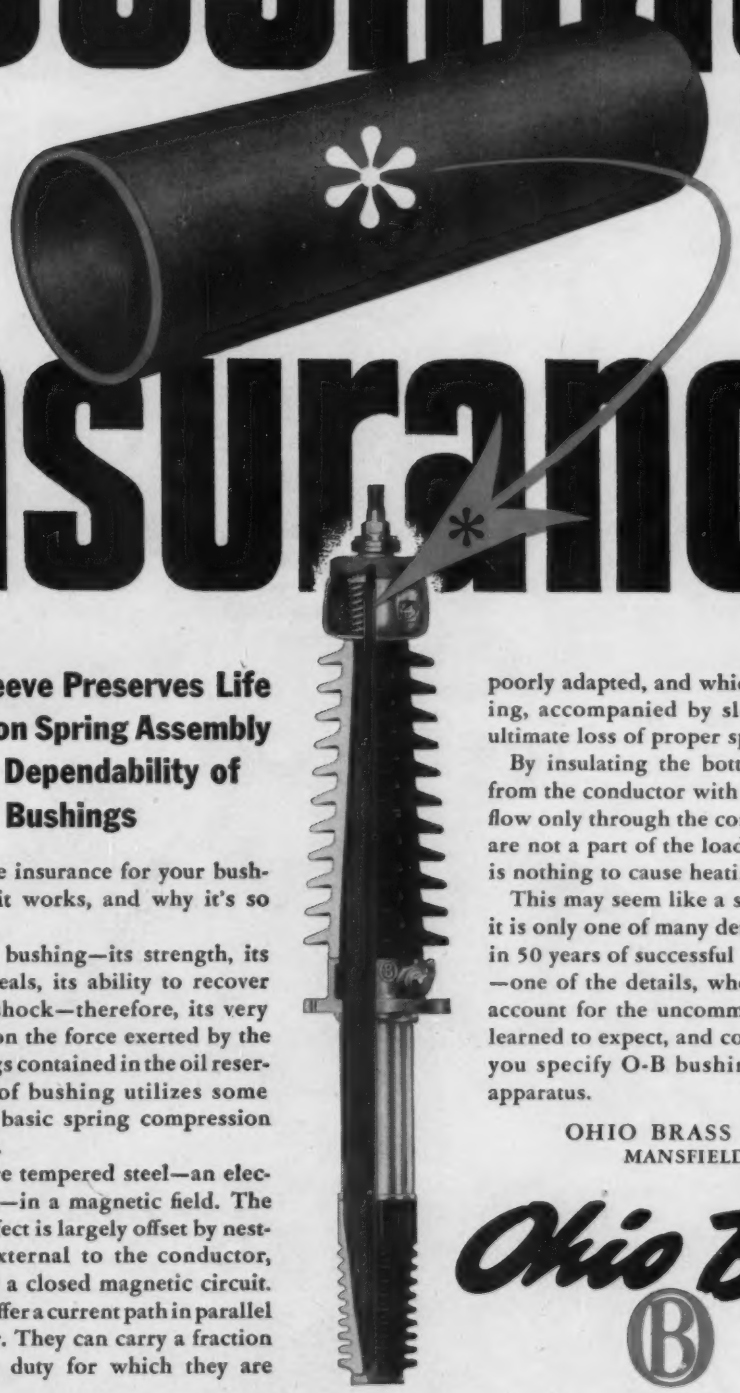
Thermal capacities are high for contingency load conditions. Liberal ducts throughout both high voltage and low voltage coils assure ample circulation of cooling liquid.

Attention to detail, as exemplified by many design, construction and easy-maintenance features, has given Allis-Chalmers transformers an outstanding reputation for performance and reliability. Get the complete story. See your Allis-Chalmers representative or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

Bushing Insurance



Insulating Sleeve Preserves Life of Compression Spring Assembly ...Adds to Dependability of O-B Bushings

This sleeve is life insurance for your bushings. Here's how it works, and why it's so valuable.

Assembly of the bushing—its strength, its air and moisture seals, its ability to recover from mechanical shock—therefore, its very life, all depend upon the force exerted by the compression springs contained in the oil reservoir. Every make of bushing utilizes some adaptation of this basic spring compression assembly principle.

These springs are tempered steel—an electro-magnetic metal—in a magnetic field. The inherent heating effect is largely offset by nesting the springs external to the conductor, thereby preventing a closed magnetic circuit. But, these springs offer a current path in parallel with the conductor. They can carry a fraction of line current—a duty for which they are poorly adapted, and which can produce heating, accompanied by slow annealment and ultimate loss of proper spring force.

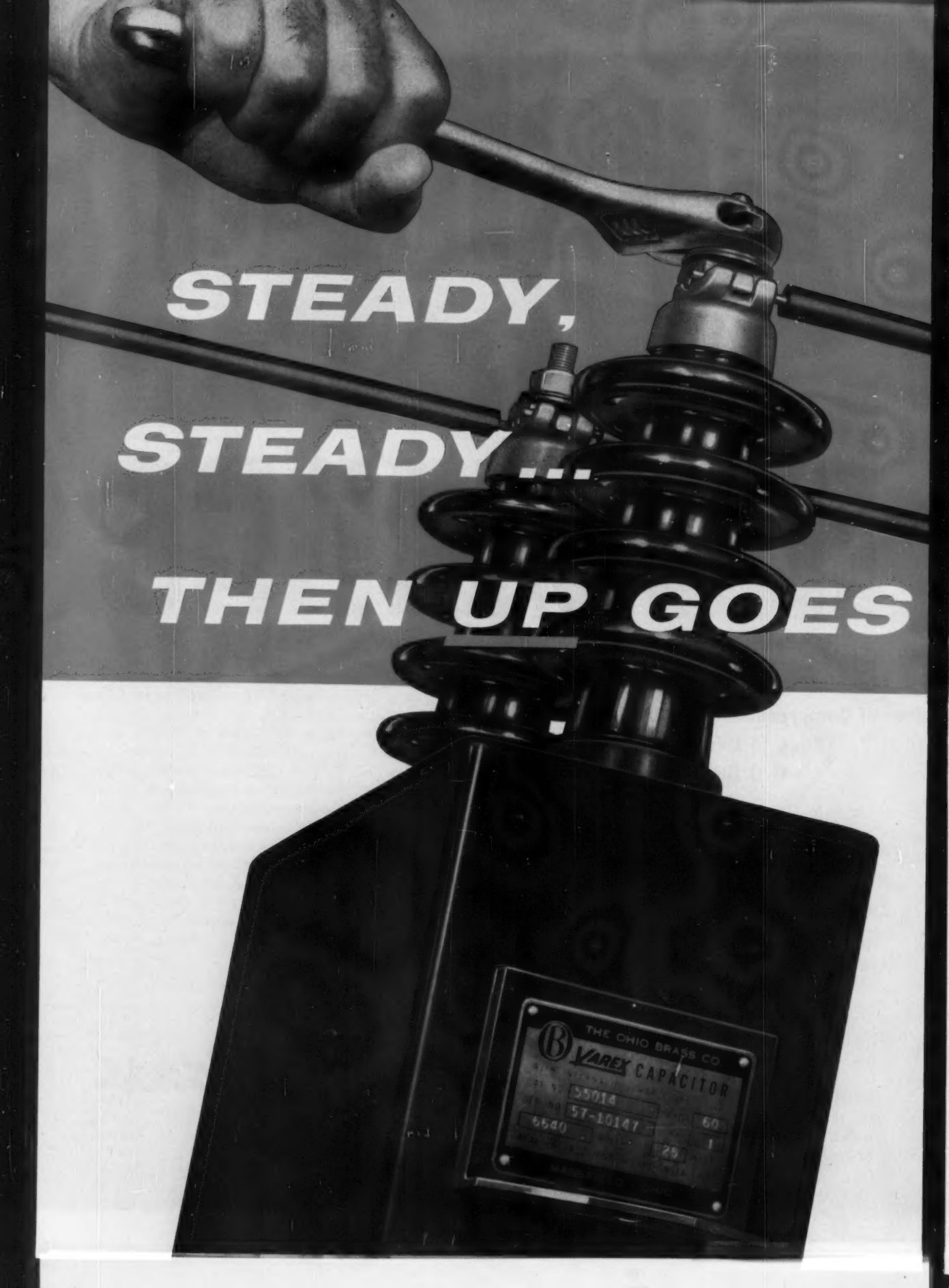
By insulating the bottom of the reservoir from the conductor with a sleeve, current can flow only through the conductor. The springs are not a part of the load current path. There is nothing to cause heating.

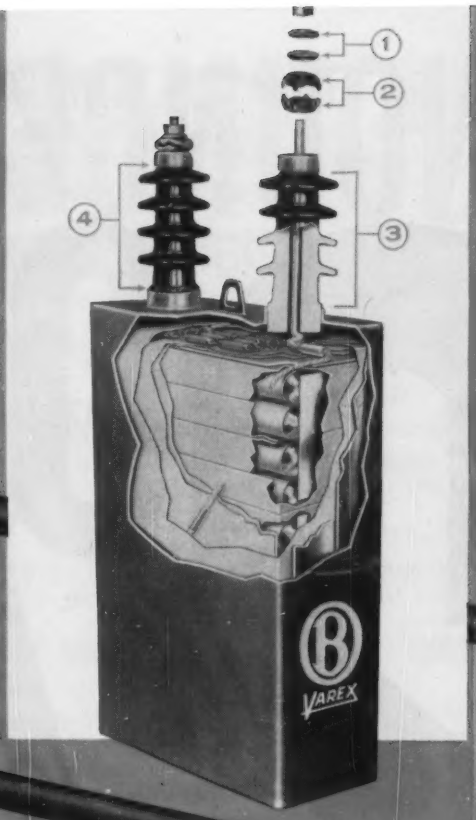
This may seem like a small detail. Actually, it is only one of many details O-B has learned in 50 years of successful bushing manufacture —one of the details, when all added-up, that account for the uncommon reliability you've learned to expect, and consistently find, when you specify O-B bushings on your station apparatus.

OHIO BRASS COMPANY
MANSFIELD, OHIO

Ohio Brass

4795-H


STEADY,
STEADY...
THEN UP GOES
THE OHIO BRASS CO
VAREX CAPACITOR
55014
57-10147
6640
60
1
25



1 Follow-up Pressure On Conductor

Belleville spring washers exert follow-up pressure so there is no relaxing of 1000-pound clamping force, even if conductor "cold-flow" occurs.

2 Identical Clamp Halves

Either half can be used in either position, top or bottom. Stud is staked so that nut will not come off accidentally when conductor is inserted.

3 Long Leakage Distance On Bushings

Leakage distance is well in excess of NEMA standards. Petticoat design promotes natural cleaning by rain. Wet process porcelain comes from O-B's own plant.

4 Solder Joints Are Always Under Compression

The joints between the stainless steel cap and the top of the bushing and between the base of the bushing and the container top are solder sealed in such a way that the joints are always under compression. Temperature change will not affect the method of loading.

THE TORQUE!

It's easy to tell when VAREX terminal nut is tight, but even if over-tightened, all that's lost is a STANDARD nut . . . . . .

You can *feel* and *see* when the terminal nut on a Varex capacitor is tightened properly. Turn the terminal nut with a steady torque for several turns. Then the torque suddenly increases. Looking at the Belleville spring washers, you can see they've flattened.

But suppose the lineman fails to note these two signals. Suppose he goes ahead and over-tightens the nut. No damage can be done to the terminal or the bushing. The nut will strip without damaging the stud threads since the crests have been removed from the threads. True, the nut is stripped, but it is a standard brass nut, readily replaceable from the stock room.

There are many other important advantages of Varex terminal and bushing design . . . the fact that the clamp halves are identical, the long leakage distance on the bushings, the use of a stainless steel cap that loads the bushing porcelain only in compression, to name a few.

If you're interested in the details on Varex terminal design, your O-B district manager will be glad to tell you all about them, or write for capacitor bulletin, 1374-H.

OHIO BRASS COMPANY • MANSFIELD, OHIO

Ohio Brass

ALCOA ANNOUNCES

62%

CONDUCTIVITY FOR ALUMINUM CONDUCTORS

CONDUCTIVITY GUARANTEED—All difficulties and technicalities involved in supplying this new high-quality conductor have already been worked out. Right now, we are shipping redraw rod and conductor with minimum guaranteed conductivity of 62% IACS (International Annealed Copper Standard).

NO DECREASE IN TENSILE STRENGTH—Users of Alcoa® Aluminum Conductors will have to make no adjustments to compensate for changes in physical characteristics of this new high-conductivity conductor. There has been no downward revision in tensile strengths or mechanical properties of Alcoa redraw rods or conductors.

NO INCREASE IN COST—This remarkable new development in electrical technology is offered to the industry at no increase in cost over EC grades of conductor formerly supplied.

WHAT THIS MEANS TO YOU—The advantage in using 62% aluminum conductor can be computed as an increase in the conductivity of the conductor. Assuming the following conditions, here is a rather favorable example based on the capitalization factor:

1,113,000 cm 61 strand aluminum Weight = 1.045 lbs per foot Peak load current = 600 amps
Line losses = \$0.005 per kwh Load factor = 50% Avg. operating temp. = 50°C
Interest rate on investment = 4% Amortization period = 30 years
For 61% conductivity $r_a = 0.0954\Omega$/mi. $P_L = 1^2 r_a = 600^2 \times .0954 = 34.34$ kw per conductor mile
From Section 13-1 *Standard Handbook for Electrical Engineers*, curve of annual energy loss for given peak load at various load factors.

Energy loss = $34.34 \times 2650 = 91{,}000$ kwh
Annual cost of losses = $91{,}000 \times .005 = \$455$ per conductor mile

For 62% conductivity $r_a = 0.0939\Omega$/mi.
Therefore, annual cost of losses = \$447.85 per conductor mile
Annual savings = \$455.00—\$447.85 = \$7.15 per conductor mile

$$\text{Present value of benefits} = C\frac{1-(1+i)^{-n}}{i}$$ where i = interest rate, n = amortization period, C = annual savings

$$\text{Present worth of benefits} = 7.15\frac{1-(1+.04)^{-30}}{.04} = \$123.60 \text{ per conductor mile}$$

Converting to a per-pound value

$$\text{Present value} = \frac{123.60}{5280 \times 1.045} = \$0.0224 \text{ per lb}$$

This means one could afford to pay up to 2.24 cents per-pound premium for 62% conductivity aluminum conductor based on the annual benefits received.

Or, on the other hand, if you're a skeptic and not particularly concerned with the future, consider that one merely wants to buy a conductor of a given resistance. If the price of 1,113,000 cm 61% conductivity is \$0.3902 per lb, the resistance equivalent 62% conductivity conductor yields a benefit of $62/61 \times .3902$ or \$0.3967 per pound.

This means, of course, that the 62% conductivity conductor represents a saving of \$0.0065 per pound.

Your Guide to the Best in Aluminum Value

"ALCOA THEATRE"
Exciting Adventure, Alternate Monday Evenings

AN EXTRA HEAVY DUTY PERFORMER!

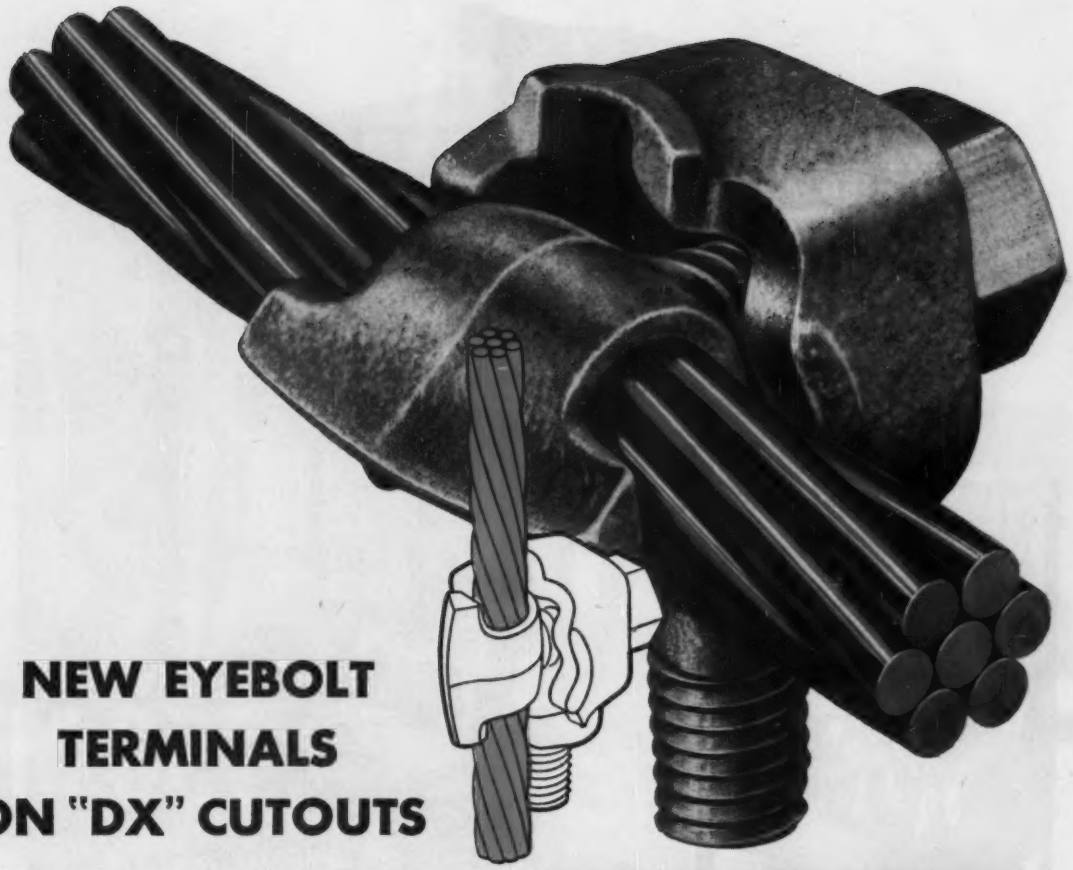
10,000-amp interruption conclusively PROVED in the High Power Lab!

To provide the *extra* measure of protection so vital on your growing distribution lines, Westinghouse has extended the capacity of its time-proven line of open fuse cutouts. The Extra Heavy Duty "DX" cutout not only interrupts faults of 10,000 amperes safely and dependably, but will do it time and time again . . . without failure!

Under the worst field conditions, simulated at the Westinghouse High Power Laboratory, the new Extra Heavy Duty "DX" cutout was given the thorough kind of workout that assures you of reliable circuit protection on 5.2, 7.8 or 15 kv lines . . . with 100-amp continuous rating. A rugged load-break device, shown above, is available for economical switching of lines under full load.

For further information on the improved "DX" cutout, contact your Westinghouse Sales Engineer, or write direct to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-60936

YOU CAN BE SURE...IF IT'S **Westinghouse**



NEW EYEBOLT TERMINALS ON "DX" CUTOUTS

Westinghouse open-fuse cutouts are now being supplied with high-strength copper alloy eyebolt connectors to make installation of these dependable units easier than ever. Terminals are tin-plated for use with either aluminum or copper conductors . . . from #6 to #1/0 ACSR stranded wire.

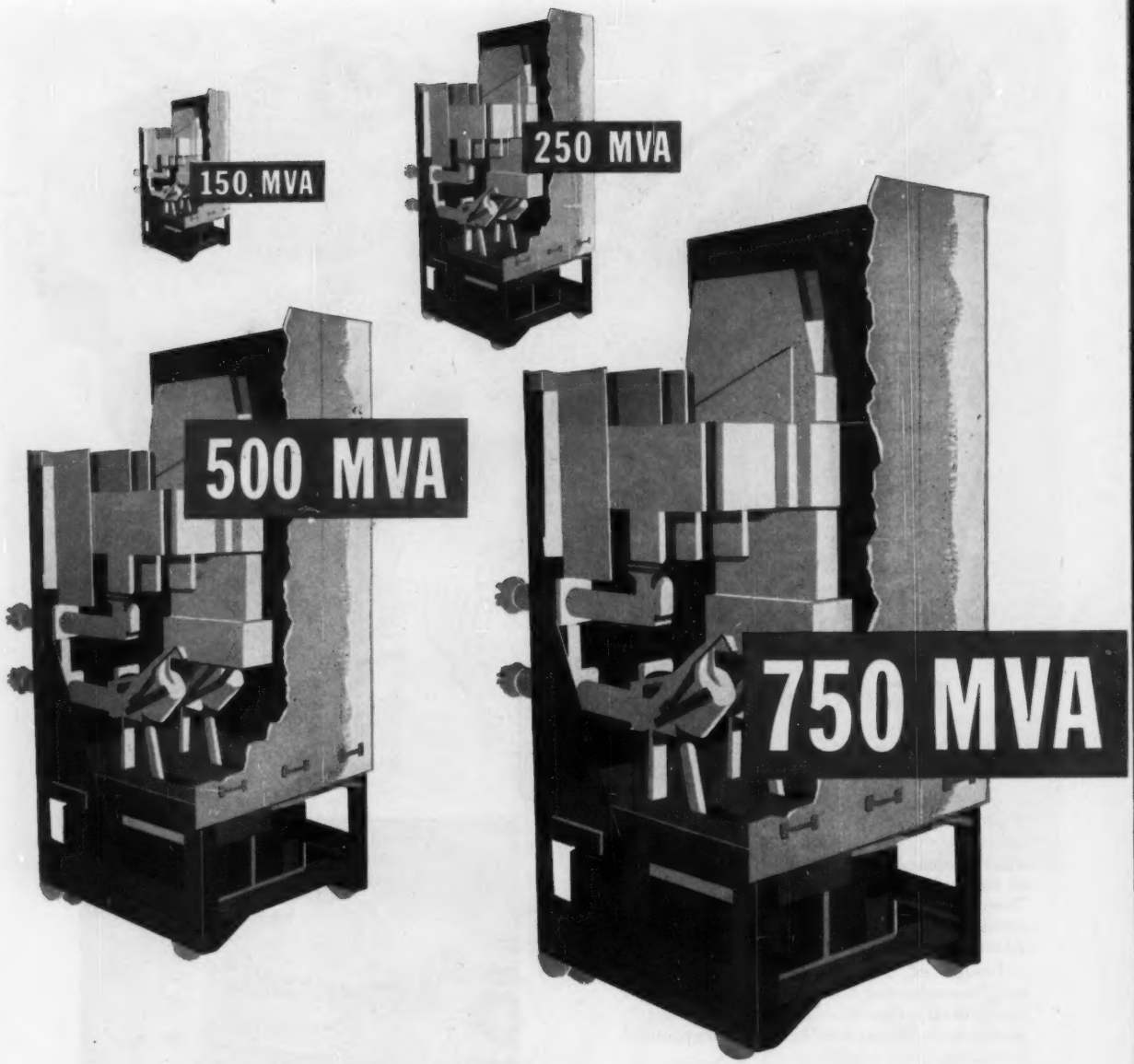
Design of the new connectors permits simple conductor take-off . . . vertically or horizontally. Speeds connection with heavy conductors. Shakeproof lock washers prevent loosening from vibration.

Tensile strength of eyebolt is 85,000 psi . . . rugged enough for compression of heavy stranded wire. Electrical bronze current-carrying member has ample capacity to handle maximum currents of large conductors. J-60938

For more information about the Westinghouse line of "DX" cutouts with interrupting capacity up to 10,000 amps, call your Westinghouse sales engineer or write Westinghouse Electric Corporation, P. O. Box 868, 3 Gateway Center, Pittsburgh 30, Pennsylvania.

YOU CAN BE SURE...IF IT'S

Westinghouse



Westinghouse paces industry
by introducing the

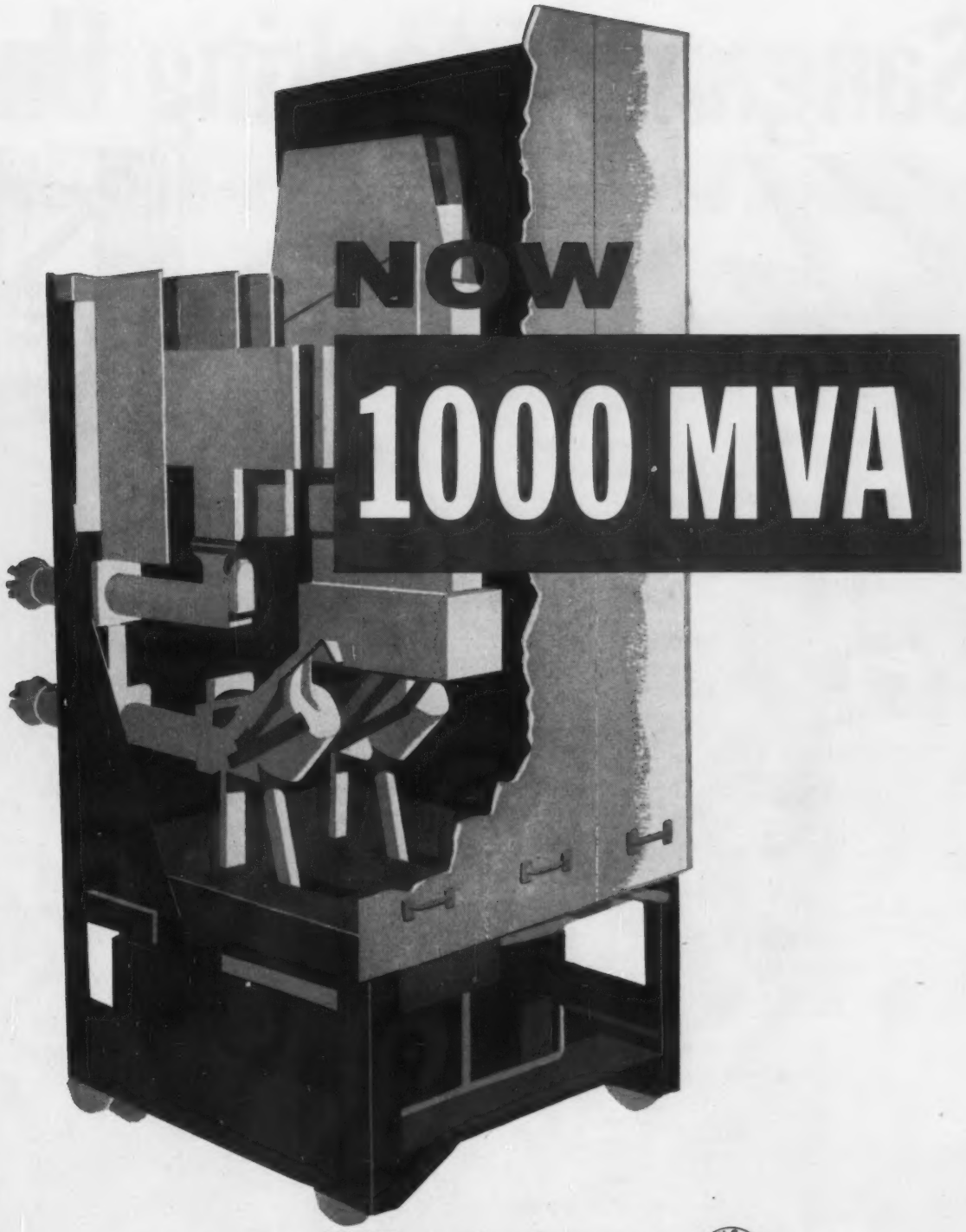
WORLD'S FIRST MAGNETIC CIRCUIT BREAKER TO INTERRUPT 1 MILLION KVA FAULT

1200 and 3000 continuous ampere capacity

The time-tested and proven design of the De-ion principle of circuit interruption has again lent itself to increased capacities. Westinghouse engineers, constantly aware of your needs, have now adapted the De-ion principle to the new 150 DH 1000 breaker that interrupts faults up to the magnitude of 1 million KVA . . . highest magnetic breaker interruption capacity in the industry!

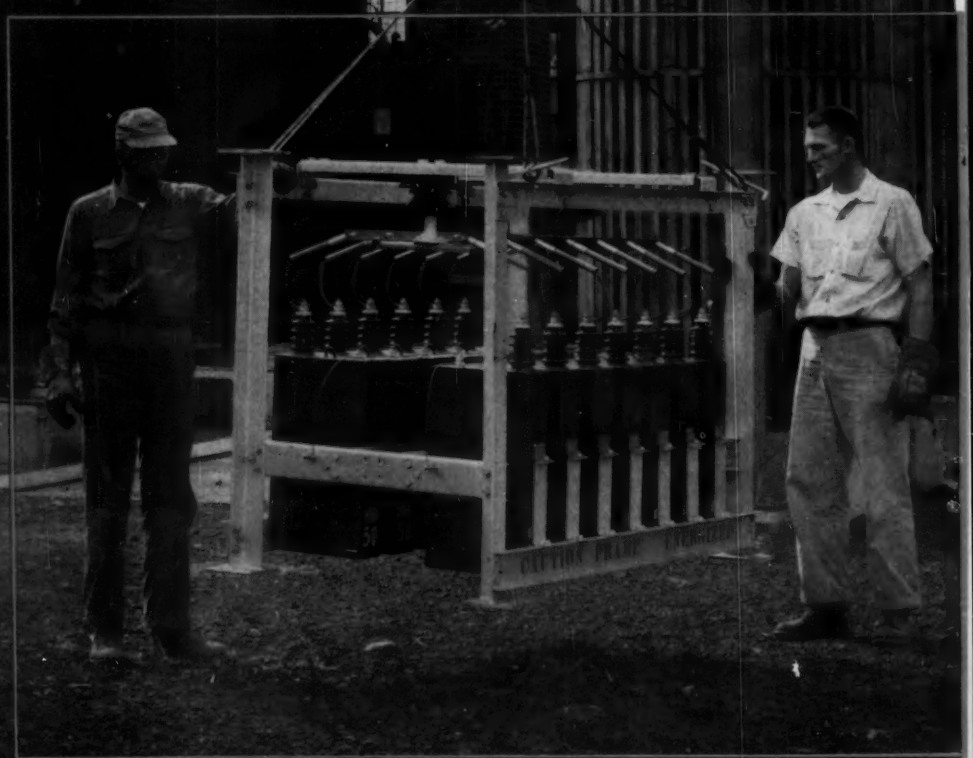
WHAT THIS MEANS TO YOU: It means you'll be better able to handle larger loads—safely—in large metropolitan generating substations. It means, too, that greater economy will be realized in utility and industrial substations of high capacity.

J-60926



YOU CAN BE SURE...IF IT'S Westinghouse

Sangamo Stacking Unit



9C57-S

Typical 700 Kvar NEMA Standard Sangamo Unit swings off the truck to add Kilovars at the lowest possible cost.

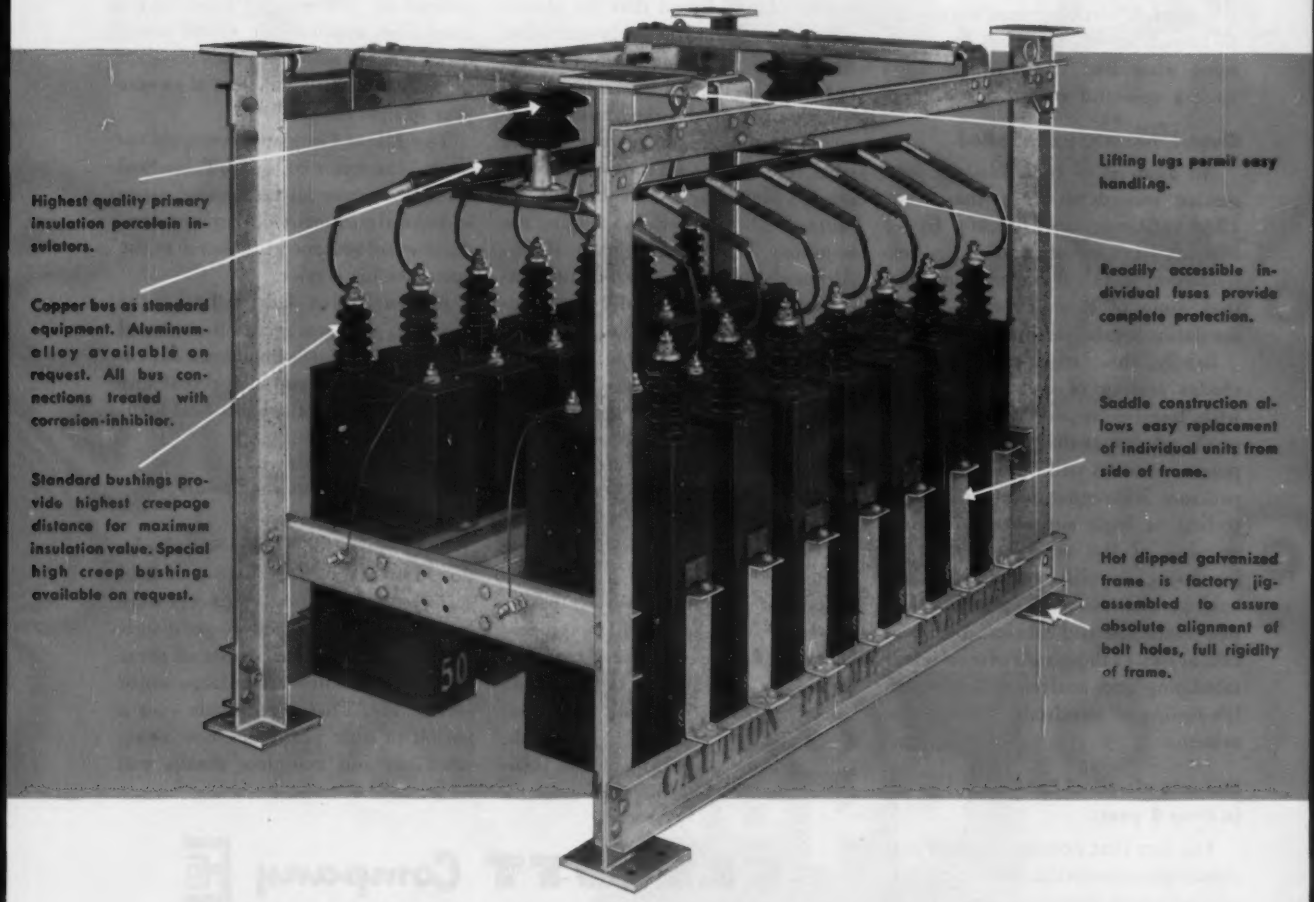
Capacitor Equipments

cut installed kilovar costs to the minimum!

Sangamo primary power capacitors are now available in factory-assembled stacking unit equipments. Ready to install at key points on your system, they can supply large blocks of kilovars at lowest installed cost per kilovar.

Here's why . . . the unit type design saves you man-hours and construction costs. Equipment designs provide additional savings on footings, base support insulators and connecting materials. Equipments assembled with 50 Kvar units put maximum Kvar into the smallest space.

Save cost, time, and space in your substation by stacking your kilovars with Sangamo Equipments. NEMA standard racks are furnished as standard catalog items. Special designs are available on request.


Highest quality primary insulation porcelain insulators.
Copper bus as standard equipment. Aluminum-alloy available on request. All bus connections treated with corrosion-inhibitor.
Standard bushings provide highest creepage distance for maximum insulation value. Special high creep bushings available on request.
Lifting lugs permit easy handling.
Readily accessible individual fuses provide complete protection.
Saddle construction allows easy replacement of individual units from side of frame.
Hot dipped galvanized frame is factory jig-assembled to assure absolute alignment of bolt holes, full rigidity of frame.
50
CAUTION FRAME ENERGIZED

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

Fabri-Seal Insulation Failure Investigated

Introduced by Elliott in 1948. Achieved 8-year field service record. First failure occurred in 1957. Causes investigated by Elliott engineers.

The Elliott Company, which takes pride in the service record of its stator coil insulation for large induction motors, had some explaining to do this fall when its much-publicized Fabri-Seal insulation experienced its first failure.

Fabri-Seal insulation was introduced in 1948, installed in motors serving utilities and industries all over the country. According to Elliott's Ridgway sales management, "these motors shattered all previous field service records with not one insulation breakdown in over 8 years." Then in late 1957 the first failure occurred. Elliott engineers were quick to launch an investigation to determine what had happened to spoil such a splendid record.

Over 1,900,000 hp installed

An analysis of the tabulated field service records confirm that since 1948 more than 1,900,000 hp of Elliott's large motors with Fabri-Seal insulation were put into service and that none of them experienced an insulation breakdown in nearly 9 years.

Briefly, this insulation system includes sealing of coil slot sections with hand-wrapped Mylar*-backed mica, plastic-sealing at vulnerable points, vacuum preconditioning and pressure impregnation, turn-to-turn testing at high surge voltages, immersion of the complete stator in insulating varnish and subsequent baking. Obviously, it also involves new materials and fabrication methods, as well as thousands of man-hours tabulating and analyzing accelerated life-testing of hundreds of insulation systems.

Not one electrical failure in over 8 years

The fact that not one of these machines experienced an insulation failure in over 8 years was prominently exploited in literature, advertisements and in personal contacts. At the height of this promotion the first Fabri-Seal insulation failure occurred. After recovering from the initial shock, the sales management was quick to point out—and rightly so—that a failure had to happen sooner or later and that this did not in any way nullify the 8-year field service record.

First insulation failure occurred in 1957

The insulation failure occurred in a motor serving a Gulf Coast chemical plant. Elliott engineers hastened to the scene and found that the atmosphere was laden with highly-corrosive, hygroscopic magnesium chloride dust.

When this corrosive dust blanketed the winding, it absorbed moisture to an almost unbelievable extent. Failure occurred right after a torrential downpour deluged the area with 11 in. of rain in a 24-hour period, bringing the humidity in the area near 100%. Although the weather-protecting enclosure kept out the rain, the magnesium chloride with its water-absorbing action literally "sucked" the moisture out of the air onto the coils.

"In effect," the engineers reported, "the motor has been operating in a brine solution, practically the equivalent of being submerged. Furthermore, the corrosive dust had attacked the paint, steel baffles, and even brass name plates."

It must be said, however, that at no time did the Elliott engineers blame the failure on the severity of the operating conditions. At the same time, they were still not convinced that Fabri-Seal insulation was at fault. In their opinion, Fabri-Seal coil insulation *simply would not fail*—even in such highly-corrosive and moist atmospheres.

How Elliott engineers solved the problem

With the customer's permission, the motor was returned to the factory for further investigation. After careful examination, Elliott engineers announced that "the motor revealed irrefutable evidence of faulty materials and workmanship,"—quite an embarrassing thing to have to admit.

"Our only consolation," Elliott engineers reported," was that this failure occurred in what our customer described as 'the world's most severe insulation application' where every major make of motor has been installed . . . and has failed in less than one year of operation."

The Elliott Company promptly rewound the stator coils with Fabri-Seal insulation, gave all mechanical parts additional treatment for corrosive conditions and returned the motor to the customer for service.

Although this failure broke the continuous service record that started in 1948, Elliott sales management reported that, "it did not reveal any basic weakness in the Fabri-Seal Insulation System."

Elliott's continuous insulation research

Even while Elliott Fabri-Seal insulation was establishing the 8-year field service record, Elliott engineers were busy life-testing a new Super-Fabri-Seal insulation. The results of these tests forecast a new era in large motor service life. They were made over a period of nine years, are now being tabulated and complete details will be released at an early date.

*Dupont Trademark

ELLIOTT Company

Ridgway Plant, Ridgway, Pa.

R7-34

Tie it . . . clamp it . . . the conductor carries the current, but the *porcelain* insulates it from ground. Lapp builds the Line Post with either type of conductor head for maximum convenience of installation . . . and it builds the *porcelain* to do the *insulating* job. The porcelain in either case is a closed-end post, of high density vacuum-process electrical porcelain. It won't puncture because it has no conductive material within it. It outperforms any other type of insulator in dirt conditions because its fog-type design prevents leakage flashover from non-uniform leakage resistance. It stands up under arcover, stones and bullets because its short, sturdy petticoats protect the body. And it won't crack because its hardware, both top and bottom, is *externally* attached, and can load porcelain only in compression.

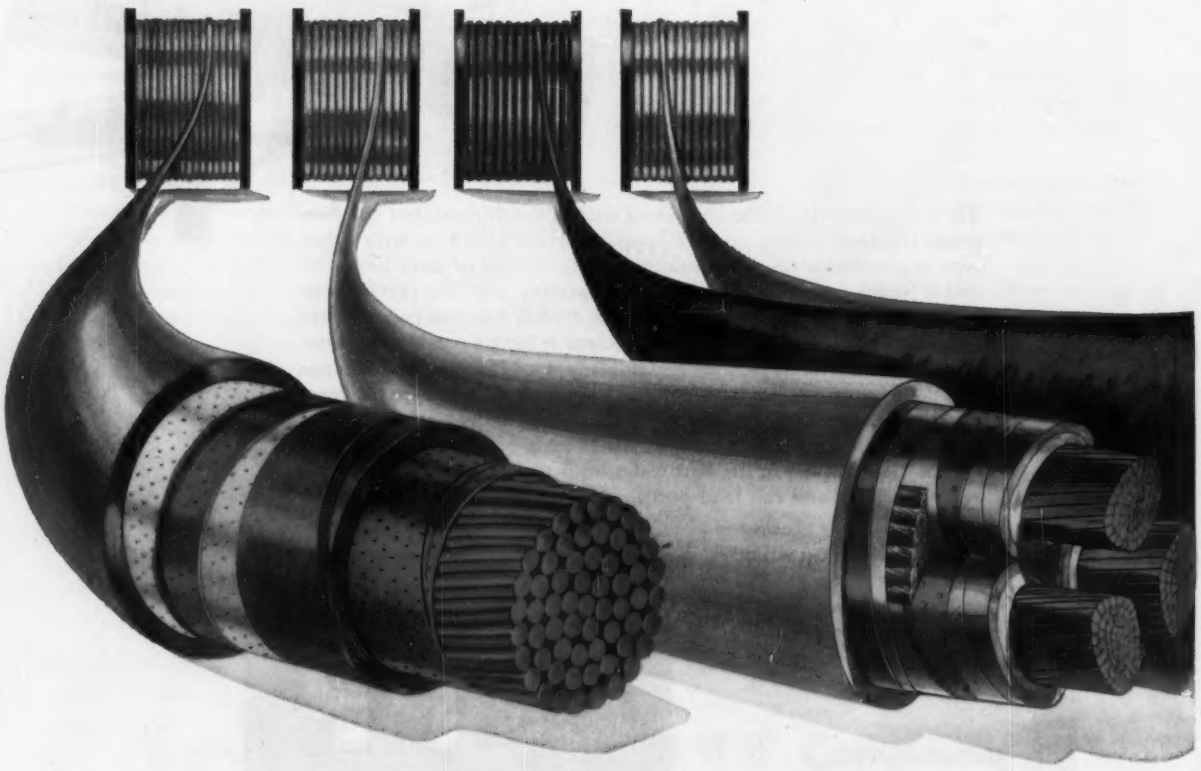
With tie-wire or clamp-top, the Lapp Line Post will give you an *extra* margin of operating security, low upkeep, long life.

Lapp Insulator Co., Inc., Le Roy, N. Y.

Lapp

FOR THE MOST EFFICIENT
POWER DISTRIBUTION . . . SPECIFY

PAPER-INSULATED CABLES BY PHELPS



Single conductor, 1 KV and up

Three-conductor, 1 KV and up

DODGE!

Phelps Dodge paper-insulated power cables have a *demonstrated record* of long life in a great variety of designs for all types of applications—underground duct, direct burial, submarine and aerial.

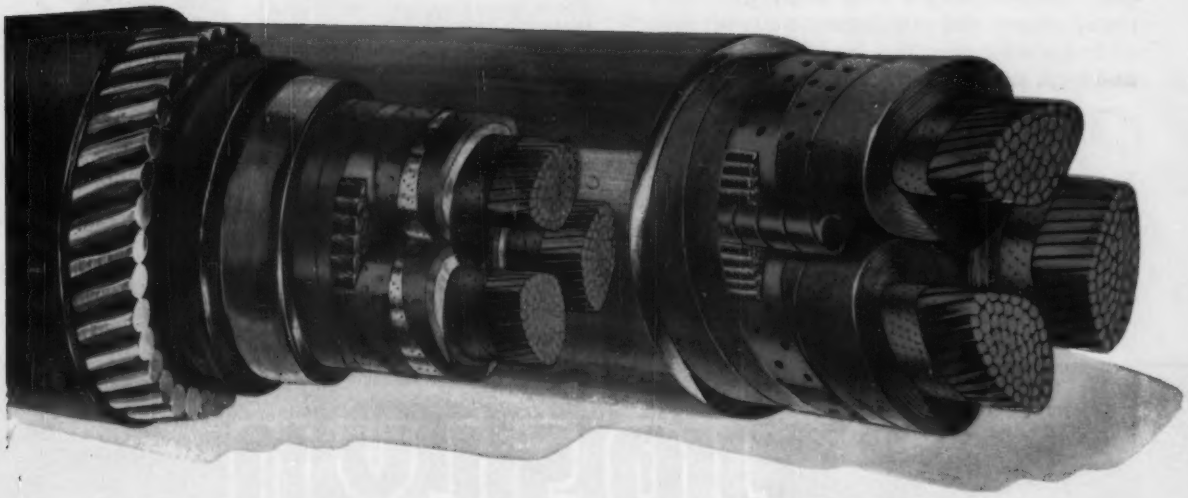
Paper-insulated cables have these important inherent characteristics that improve operating performance and lengthen service life:

- Extra high 60-cycle and impulse strength to withstand switching and lightning surges.
- Ability to handle large blocks of power in single cables of minimum dimensions.
- Positive protection against all contaminations, due to being hermetically sealed in an extruded metallic sheath.

Paper-insulated cables can be supplied with either lead or aluminum sheaths.

Phelps Dodge offers the widest range of high voltage cables to the electrical industry.

PHELPS DODGE COPPER PRODUCTS
CORPORATION
300 PARK AVENUE, NEW YORK 22, NEW YORK



Submarine, 1 KV and up

Low-Pressure gas-filled, 8 KV and up

JOSLYN

VALVE ARRESTER

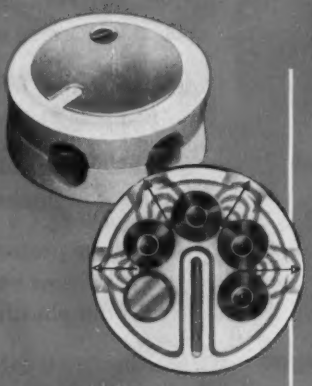
Introduces a new dimension in durability

The new Joslyn "Micro-Pack" valve element not only provides improved operating characteristics but achieves a new high in DURABILITY. A specific formulation of silicon carbide grains of controlled resistivity is vibration packed into a dense stable composition without the use of cement or binders. *All ingredients of this Valve element can withstand 4000°F without fusing!* This means higher thermal capacity without the tendency to form "hot channels" and fulgurites.

Extreme Durability in the Valve element alone doesn't impart durability to the *whole* arrester—the Quench Gap operating in series shares the responsibility for over all performance. The new Joslyn quench gap system meets this high durability requirement and provides the advantages of space economy, low impulse sparkover and high arc-quenching efficiency.

EXTERNAL ISOLATING GAP

Large enough to withstand arrester rated voltage . . . prevents line lockouts (pioneered on Joslyn Expulsion Arresters since 1935).



QUENCH GAP STRUCTURE

Circular arrangement of multiple horizontal gaps produces inherent forces—magnetic and pressure—which cause arcs to elongate radially outward without the use of field coils and by-pass gaps . . . combined elongation and cooling quenches follow-current arc.

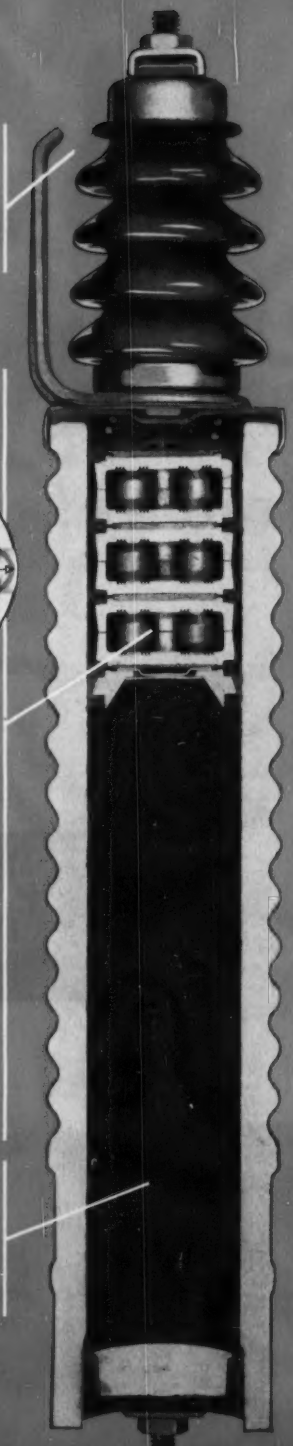
Horizontally positioned electrodes . . . prevent short-circuiting due to electrode beading caused by power system transients or other long duration overvoltages.

Inner-structure . . . directs arc generated metallic vapors away from critical insulation.

Capacitance plates . . . distribute voltage uniformly between gap units.

VALVE ELEMENT

High density "Micro-Pack" silicon carbide of controlled grain size and resistivity without cement or binder . . . provides extreme durability and high thermal capacity to withstand long duration operations.



JOSLYN COMPLETE POLE LINE EQUIPMENT

JOSLYN

MFG. AND SUPPLY CO., 155 North Wacker Dr., Chicago, Illinois

Power Transformer Loading Practice Needs Review!

The practice of loading power transformers above maximum nameplate rating, both in normal and emergency operation, is virtually a universal practice today among electric utilities. It had its initial recognition during World War II as an emergency expedient. The practice has achieved acceptance thanks largely to the ASA Transformer Loading Guide.

Today, however, there is evidence that the ASA Loading Guide is no longer being widely followed as the basis for normal or emergency loading. In fact a survey of power transformer operating practice soon to be published (Dec. 23) by Electrical World reveals that 38 out of 82 power systems do not follow the Guide in loading units above rating in normal operation.

As to emergency conditions, it is also apparent from the survey that loading practice is inconsistent from system-to-system and has little, if any, relationship to ASA recommendations. For instance, five systems that permit winding temperature of 105 C in emergencies, variously allow it to prevail for periods of one, four, six and eight hours before resorting to load relief. Two other systems permit winding temperatures of 150 C and 130 C to exist for 20 minutes in one instance and for 8 hours in the other, before relieving load!

Such findings suggest that the time may be ripe for the industry to review the whole area of power transformer loading. It may well be that the ASA Guide has served its purpose in fostering higher transformer loading as a practice, and putting it on a safe, practical footing at the outset. Perhaps the complex and conservative nature of the Guide, so necessary at the outset to spur conservation of capacity, is no longer consistent with practical operating needs.

In any event, it would certainly seem that experience in the use of the Guide, coupled with the results of functional life testing of insulation and other investigations, should by now have provided enough new knowledge to show how the ASA Guide could be revised to provide an operating document to guide present practice.

The Unrealized Promise of Electric Heating

Electric heating today is definitely on its way to becoming a major method of heating American homes in the future.

Electrical World's Second Space Heating Survey, reported in this issue (page 95), confirms this fact. It shows that there are some 290,000 completely electrically heated homes and buildings in the United States today, not counting 23,500 heat pump installations.

Next year, the report predicts, utilities may expect to add something like 31,000 new resistance heating installations and 13,500 more heat pumps.

This is a promising prospect and it demonstrates that space heating can be sold in the face of such obstacles as a drop in new home starts, tight money and a slowing down of the national economy.

But while the report shows that electric heating is indeed growing, it also shows that heating has not grown as much as we might have hoped. There are reasons for this, and these reasons affect much more than the electric heating business, or, for that matter, the electric power business.

Until these reasons are removed and all utilities unite in promoting it, the full promise of electric heating, as a utility load builder and load balancer, will remain unrealized.

Atomic Alternative – Partnership or Preference

In a recent editorial we recommended increased leadership by utilities in nuclear power development. Our recommendation is based simply on the observation that imminent changes in our nuclear power policy will result in more federalization of nuclear power unless greater participation by utilities is forthcoming.

This imminent change in our nuclear policy will most likely mean a shift in emphasis to the building of large nuclear power plants. Of all the possible approaches to economical nuclear power this one—the building of large plants—is an approach where maximum use of utility experience could be applied.

Utilities should therefore take the initiative if such a plan is offered. Individual utilities cannot of course finance such uneconomical undertakings as building large scale nuclear power plants. Partnership with the government will be necessary.

This may seem alien to some. But the alternative could only mean complete federal domination with power distribution under the preference clause—an instrument of socialism very familiar to utilities.

Utilities Turn to

- **Interest grows in rates that promote space heating and heat pumps to fill load valleys**
- **Problems: fixing a schedule that promotes, not discriminates, and educating customers on benefits**

By using gas to heat your home you can save enough to put your son through college.

This, in effect, is what ads of an Arkansas gas company proclaim. The gas firm's stepped-up advertising isn't based entirely on an altruistic interest in higher education. It's a matter of self-defense.

Since Arkansas Power & Light Co introduced a new rate last October to promote electric house heating and heat pumps, the competition has found good cause for alarm.

AP&L expects to sell about 100 electric heating installations in 1957 and a minimum of 316 jobs next year.

Basically, AP&L's rate provides heating energy at 1.2¢ per kwhr during the six winter months for customers with heat pumps or with at least 4 kw of electric heat.

Under the residential rate, which excludes water heating, the first 60 kwhr cost 3.9¢ each plus a 55¢ service charge. The next 140 kwhr cost 2.9¢ each, and anything over 200 kwhr costs 1.9¢ per unit. If the customer has a heat pump or electric heating, all monthly energy over 500 kwhr billed from November through April is at 1.2¢ a kwhr.

Water heating is metered separately and controlled off peak. This energy is billed at a rate of 1¢ plus fuel, which amounts to about a 1.2¢/kwhr total.

Arkansas P&L is going after electric heating "because it's good business," says W. M. Shepherd, vice president in charge of sales. "The new competitive rate makes it possible to sell all customers electric heat and, thus, get saturation. With a non-competitive rate you can't expect to sell heating, except to the high-income customers who consider it a luxury."

This competitive viewpoint is gaining a growing number of advocates. Although the trend is relatively small, it is in evidence across the U. S. from Washington Water Power Co's 42-year old special water-heating rate to Western Massachusetts Electric Co's 16-day old change to a rate to boost house heating.

The Federal Power Commission's National Electric Rate Book shows that 18 privately owned companies have separate rate schedules for residential space heating and/or heat pumps, according to a tabulation by Ebasco Services, Inc.

Only six months ago a similar study turned up an even dozen companies with such rates, an Ebasco man says. For results of EW's survey on electric heating see page 95.

The Rural Electrification Administration reports that most co-ops have both special house heating and water heating rates. REA doesn't generally recommend a special rate. It suggests use of the last block of the regular farm and home rate for promotional purposes.

A group of North Dakota co-ops uses a pro-rated flat charge of $7.50 for bringing service to the farm. Thereafter all electricity is sold at 1¢/kwhr regardless of volume.

Water Heat Rates in Wide Use

Water heating is at special rates for many co-ops. It is not metered separately. About 75-80% of all private companies have special rates for water heating also, estimates one industry spokesman.

These factors point up the trend. But from both the east and west coasts come some salient views on problems of rates that promote special business.

As Southern California Edison Co Rate Engineer C. L. Ashley points out, management wants to take a long term outlook before requesting a new rate structure that might require a reversal due to changing conditions in future years.

A utility must be certain, Ashley cautions, that if one group pays less for electricity this does not impose a burden on other users. The California regulatory commission is not alone in basing a conservative class rate view on this danger.

For these reasons, Ashley foresees fewer rate schedules that are designed to promote increased usage of electricity for specific purposes, ie, heat pumps, space heating, or hot water heating.

Says Stuart W. John, Common-

Promotional Rates That Compete

wealth Services' rate specialist: "I try to avoid special rates whenever possible. I'd rather have a good general purpose rate without deviations. Then, if there's no other way to get the special business the utility wants, I'd say to try a special rate."

"Ultimate saturations must be considered in setting up promotional rates," says a Washington WP spokesman. "Otherwise, before too long the tail begins to wag the dog and results in the possibility of discrimination."

Problems Posed in Changes

There are other considerations. First, any rate change is going to take time and money for the study, filing the new schedule with the commission or obtaining the home rule city's okay, and educating customers and employees. Some utilities hesitate on a special rate for fear of antagonizing neighboring electric suppliers who prefer the status quo, says an observer close to the industry. Commissions haven't exactly distinguished themselves for special rate ruling consistency. And, finally, some growth companies earning a healthy rate of return prefer not to bring up rate matters at all.

Actually, as John points out, probably 99.9% of electric utilities use promotional rates in the sense that rate steps provide lower unit cost as kwhr consumption goes up. It's likely that a semantical change is underway, though. Utility men not too close to the rate department more and more refer to class rates for special uses as "promotional."

However it's defined, the special-use rate likely will be a fixture for the forseeable future. It is a tool, often the main tool, in the perennial effort to fill load valleys while waging the fight against competing fuels.

The bugaboo of discrimination may not be too tough a customer relations problem. When an occasional Missouri Power & Light Co customer asks why he is not getting benefit of a terminal step of 1¢ a kwhr, sales people put it this way:

The company is trying to sell more electricity by reducing the price slightly to large consumers. This acts as an incentive, which is used by most companies selling a product. You can get the rate by having an all-electric home. Why don't I send a man around to discuss what appliances you might need and the cost?

This answer provides a number of prospect leads for MP&L. The company established an all-electric rate in September to encourage all-purpose use. It applies only to homes that are truly all electric. The first 160 kwhr costs $5.85, the next 1,700 kwhr is at 1.2¢/kwhr, and the excess at 1¢. Energy is recorded by one meter.

MP&L also has an annual rate for high-use customers who are not all electric. It is a form of budget billing in which 11 months are estimated. The final bill adjusts for the difference. For this schedule the first 6,400 kwhr annually cost $150, the next 22,600 kwhr cost 1.5¢/kwhr. All in excess of 29,000 kwhr cost 1¢ per unit.

The company's regular residential rate has a terminal block at 1.5¢. But from November through April anything over 1,350 kwhr a month is billed at 1.2¢/kwhr.

Commissions Like Two Schedules

Missouri's commission liked the all-electric rate so well it approved them on receipt of the application and ordered them into effect. Arkansas Power & Light experienced the same accord. Its rate became effective after 30 days.

AP&L bases its rates upon a study to determine how to raise a 69% load factor by utilizing about 70 Mw of winter capacity. The study compared costs of electric heating and its benefits with gas heating, which costs about $80 a year. This comparison proved electricity is competitive at 1.2¢ a kwhr, which is about the incremental cost of energy generated by the 70 Mw.

The study also indicates a 50% saturation of heating will give AP&L a winter peak. When this happens, the company can investigate rate reductions for summer.

Here are highlights from other promotional rate schedules:

- Washington Water Power set up a flat rate for water heating in 1914. This evolved to a metered rate of 8 mills/kwhr. In 1940 a block at 7 mills was included in the residential rate with a time clock control. After five years the clocks were removed allowing natural diversity to control, which resulted in no apparent increase in feeder demands.

A high-recovery conversion unit program started in 1955. Over 3,500 customers have taken advantage of the change for a flat charge of $17.50. Over-all residential demand and load factor remain unchanged. Present saturation for water heating is now above 90%, says WWP. Budget billing began last June, particularly for house heating which is on regular rate.

- Los Angeles Dept of Water & Power is experimenting with a large-use rate. Customers qualify when electric cooking and water heating are used or where all air heating is by heat pump or reverse-cycle type cooling and heating. The rate provides a 1.3¢ step after first 100 kwhr vs 1.8¢ on the regular schedule. Controlled-water-heating rate is 8.5 mills a unit for all kwhr, but customer acceptance has been slow. Budget billing is not used.
- Southern California Edison Co bills storage-type water-heating customers at 1.1¢/kwhr for all over 210 hours up to 660. Usage above and below is at regular 1.4¢ rate. The company has option to institute controls but doesn't feel it necessary nor economical to do so now. Budget billing isn't used.
- Indianapolis Power & Light Co uses a 1.7¢/kwhr house-heating step where primary heat source is electric. Budget billing is available.
- Union Electric Co submeters fast-recovery water-heater energy for commercial customers who pay 1.5¢ a kwhr from November through June. Summer rate is 2¢.

McAfee: Background of leadership

McAfee Is New Head of EEI; Corette Gets Vice Presidency

Board of directors appoints them to serve until June '58, and praises work of Donald S. Kennedy as he resigns

J. W. McAfee is new president of Edison Electric Institute and J. E. Corette succeeds him in the vice presidency. Both McAfee, who is also president of Union Electric Co and Corette, Montana Power Co president, will serve in their new EEI capacities until June of 1958.

The action, taken last week by EEI's board of directors at the quarterly meeting, followed Donald S. Kennedy's resignation from the presidency.

In asking to be relieved of the office, Kennedy cited the heavy demands of both the EEI position and his duties as board chairman and president of Oklahoma Gas & Electric Co. The latter, he said, have become more strenuous due to recent retirement of key OG&E executives. He said these factors made his resignation necessary to avoid neglecting seriously one or the other.

Kennedy's 1½ Years Cited

Commenting on the "outstanding effectiveness" with which Kennedy had carried out his duties during his 1½-year term as EEI president, the board praised "the exemplary degree of self-sacrifice and devotion to the welfare of the entire industry" he displayed as president.

McAfee, who at 55 has risen to the top spot in the industry's trade organization, has a long background of leadership in the utility field.

But when he began his business career, it was the legal profession he chose. He started out with a St. Louis law firm in 1926, and within ten years had already served as special tax counsel for the city of St. Louis and as circuit court judge.

Then, in December of 1941, after four more years in private law practice, he entered the utility field—as Union Electric president.

A topic to which McAfee has devoted a lot of thought is the field of nuclear power—its potentials, its hazards, and the part electric utilities should play to bring about an aggressive and balanced program.

His own company is a member of Nuclear Power Group, Inc, one of the pioneers in the field, and "has been devoting a good deal of time and effort to nuclear power study and development since around 1950." He believes electric utility management "must carefully weigh eventual benefits against present and future costs and work out a program that will protect the interests of its customers and its stockholders."

McAfee Stresses Communication

McAfee is a firm believer in using communications effectively to create employee and public understanding. He feels it is one of the industry's biggest problems and urges full cooperation between EEI, national organizations such as PIP and ECAP, and utilities themselves to achieve more favorable understanding.

That the new EEI president himself clearly recognizes the benefits of advertising is evidenced by the "Impact" advertising campaign Union Electric launched late last year (EW Sept. 10, 1956, p 15). Feature of the campaign was a monthly hour-long TV program with Ted Mack.

McAfee's three-point formula for this, or any effective ad campaign, is "Impact, so great it will stand out from the great mass of advertising now directed toward the consumer; Emotion, so it will create a real desire in the consumer's mind for all the benefits of electrical living; and Frequency, so the consumer will not forget and so new customers will be exposed to our story."

Corette, who now moves into the EEI position vacated by McAfee, has been Montana Power's president and general manager since 1952. He also entered the utility field after practicing law for a number of years. From general counsel of Montana Power, to which he was named in 1934, he became vice president and assistant general manager, and a director in 1948.

Hoover Leads Hall of Fame Tribute to Westinghouse

Former President Herbert Hoover, posed here with George Westinghouse 3rd, led the tributes for the youth's great grandfather when a bust of the late inventor was unveiled in the Hall of Fame for Great Americans at New York University on Dec. 1.

Hoover described Westinghouse as "a rare combination of a great mechanical inventor, a great manufacturer, and a great business executive." His inventions, Hoover said, are providing employment for tens of thousands of families and helping housewives in millions of homes. Westinghouse' achievements include the air brake which bears his name and demonstration of ac for lighting in 1886.

Walter J. Barrett, American Institute of Electrical Engineers president, unveiled the bust. It is a gift from AIEE, Westinghouse Electric and Air Brake firms, American Society of Mechanical Engineers.

Search for a Program Formula Bogs Down

Series of Washington meetings explores workable A-power objectives. Results appear nebulous. Outlook is for greater federal aid or federal encroachment

The question of where this country's civilian atomic power program stands and where it is headed was surrounded last week by a multiplicity of opinions.

Out of a welter of meetings involving the Atomic Energy Commission, the Joint Committee on Atomic Energy, electric companies, reactor manufacturers, designers, and engineers, there still has not emerged any clear-cut definition of objectives of the program or means of carrying out the objectives.

Doubts for Private Industry

The activity has been sparked by mounting evidence that atomic power development is extremely costly and that the day of economic operation of U. S. nuclear power plants is a long way off. This, in turn is leading to doubts that private industry can continue to develop atomic power without either greater federal financial assistance, or abdicating its present role to the federal government.

One electric utility viewpoint came from Philip Sporn, president of American Gas & Electric Co. He told reporters in Washington that the industry doesn't think the nation's nuclear power program needs speeding up when evaluated from a domestic standpoint.

This was the consensus of utility executives at the AEC session, he said. Washington observers said the contingent did not offer a definite program for AEC to submit to Congress next month.

"The utilities are interested only in selling power," opined a manufacturer. "They aren't particularly interested in America's position internationally. The trouble is they've been given too much responsibility in guiding the program. It's not their responsibility or ours—it's the government's" he said.

At a New Orleans meeting, Westinghouse Electric Corp's Charles H. Weaver said, "Combining our domestic needs and international responsibilities, we have a mandate to get on with the job of developing atomic power," the vice president of atomic power activities said costs of the program must be shared by the U. S. government and industry and where necessary the Atomic Energy Act should be modified to facilitate a workable national program.

Charles Whitmore, president of Iowa-Illinois Gas & Electric Co, noted utilities' concern over the preference clause. "Why not repeal it and thus avoid any concern that the development of atomic power will be used to further socialize the electric power business?" he asked. This would remove some of the public-private controversy.

Need for Incentives

Incentives are needed, Whitmore believes. "To give all systems equal opportunity . . . arrangements could be made whereby the entire project would be specified by the AEC, then let by lump-sum competitive bids to interested power systems." Another recommendation is to have AEC award projects on basis that output would be sold to the successful bidder at the average kwhr cost of conventional output by its system until the cost of the atomic power was cheaper.

These steps would meet goals of the Twelfth American Assembly report on atoms for power.

Federal Power Takes New Tack

Soviet Union's build-up of water resource projects is latest argument for bigger federal government development

The Sputnik reflex appears to have caromed into the power field. Soviet programs for hydro power and inland waterway improvements are building an orbit of arguments for bigger Congressional outlays on U. S. multipurpose projects.

A recent example from the projects' advocates came last fortnight at the Mississippi Valley Flood Control Assn meeting in New Orleans. Maj Gen E. C. Itschner, chief of the Army Corps of Engineers, warned that a parallel exists between revamped military research and water resources.

The U. S. "would be very negligent if we did not build up our national economy so as to be in a better position to support a greater national military effort in advance of the possible initiation of war," Gen Itschner said.

Meanwhile, Mike Straus, former commissioner of reclamation in the Truman Administration, is preparing a report for the Senate Interior Committee dealing with Soviet development of water and power resources.

And William H. Webb, executive vice president of National Rivers and Harbors Congress, in a memo to his members warns that Russia is "pushing ahead with long-term plans for the electrification and automation of their inland waterway system."

He calls for a campaign to prevent Congress from cutting public works appropriations next year. Larger appropriations for defense, he says, "should not mean a decrease in public works, which cannot be neglected without critically impairing our defense potential."

Here's the rundown of Soviet work since World War II that Itschner gave:

- Volga development already provides the 3,000-mi mainstem of an integrated inland waterway system extending from the Black and Caspian Seas.
- Impressive hydro plants are underway at Soviet dams. The Stalingrad plant, largest on the Volga, is scheduled for operation next year. It will produce 2,300 Mw, about 18% more than Grand Coulee.
- Development is underway or planned in other river basins, including three big hydro plants in Siberia with 3,000 to 5,000-Mw capacity each.

Lighting Winners Tell How They Handled Jobs – No. 3

A *carte blanche* from the architect let Henry Koether, Wisconsin Electric Power Co, promote the main selling feature of high intensities for the bank above. Average maintained intensity is 80 ft-c. The installation won first prize in the office category of the 1957 International Lighting Competition co-sponsored by Electrical World (EW, Dec. 2, p 50). Features include indirect cove, recessed troffer, and egg-crate ceiling lighting. The job exceeded the architect's expectations, says Koether. And "he has called us on jobs since so we still have a continuity of recommendations." Connected lighting load is 100 kw for the 20,000 sq ft building.

Robert J. Huff, San Diego Gas & Electric Co, solved a familiar problem—reselling his customer on the original layout—to win the competition's $100 first prize in store lighting. The owner thought 172 ft-c was excessive. "We were called back three times by the electrician to resell and save certain parts of the original recommendation," says Huff. The building's interior is treated as one large show window. Recessed eye ball spots floodlight a stone wall in the showroom. Floods also accentuate mahogany paneling. Straight-line fluorescents that parallel the salesroom's plastic beams blend well. Load is 20 kw vs. 5 kw first planned.

Price Cut on Transformers

A price cut of about 4½% on pole-type distribution transformers was made effective by General Electric Co Dec. 6. The reduction is said to be the first sizeable cut in distribution transformer prices since 1938 when GE introduced cold-rolled, oriented-core steel.

Marc A. de Ferranti, distribution transformer department general manager, pointed out a similarity between 1957 and 1938. In both years design improvements allowed use of more mechanized manufacturing equipment. Improved methods then resulted in lower costs.

De Ferranti said the reduction also could be traced to a new distribution transformer factory recently built at Hickory, N. C. The $20-million plant investment has resulted in improved equipment and methods. Many of the new methods have been applied in the company's other plants at Pittsfield, Mass., and Oakland, Calif., de Ferranti said.

Higher Hoosier Stakes

The Hoosier Energy Cooperative, Inc, of Indiana, may increase its $42-million loan application to the Rural Electrification Administration, according to Administrator David A. Hamil.

The application, largest yet made to REA, promises to be one of the most controversial ever handled by the agency. Nine Indiana distribution co-ops have formed Hoosier, a new generation and transmission utility, and plan initially a 198,000-kw steam plant.

In addition, a Georgia firm plans an aluminum reduction plant near the proposed power station and has offered to install an additional 66,000-kw generating unit if the project goes through.

Indiana power companies now supply the needs of the co-ops and can meet their demands.

Keep 'Em Sitting

How to get along with unfriendly dogs? This is the question Toledo Edison Co's "Edison News" put to men who should know—meter readers, collectors, metermen. The findings:

- If the owners are home, have the dog confined.
- Otherwise, ignore the dog, providing it returns the favor.
- Make friends only if you both feel up to it.
- Act like you had a right to be there.
- If the dog threatens to attack, face him down. Never turn your back or run off. After a minute of staring, however, it's ok to slowly back away.
- If dog attacks, defend yourself with a stick or flashlight; make like *you're* attacking him.

Note: About the only safe generality, says W. G. Santo, meterman supervisor, is, "Nobody was ever attacked by a dog while the dog was sitting down."

Rigors of Railroading

Howard Erickson, Nebraska Public Power System operating manager, got a "line down" report last month in Columbus. The transmission line spanned a Columbus railroad track. Repercussions came quickly when he reported to the railroad:

"There's a conductor lying across your tracks."

Five Hydro Happenings

The long, involved controversy on the Niagara power project has cleared another hurdle. Federal Power Commission has omitted the usual procedure of hearing an examiner's recommendation for the $600 million project. Hearings have aired objections of New York municipalities on the proposed method of diverting water to the plant site.

After four drought years during which power generation of Hoover Dam was cut as low as 62.75% of firm output, Lake Mead is up again. Users are receiving 100% of energy allotted them.

Bonneville Power Administration cut off interruptible power loads Dec. 1 because of below-average Columbia River flows. BPA has also announced that public utility districts and municipals are now its biggest purchasers. They use 33.2% of output. Aluminum production uses 30.16%. Idaho Power Co and BPA are studying a 50-year contract for a two-way power exchange of about 200 Mw.

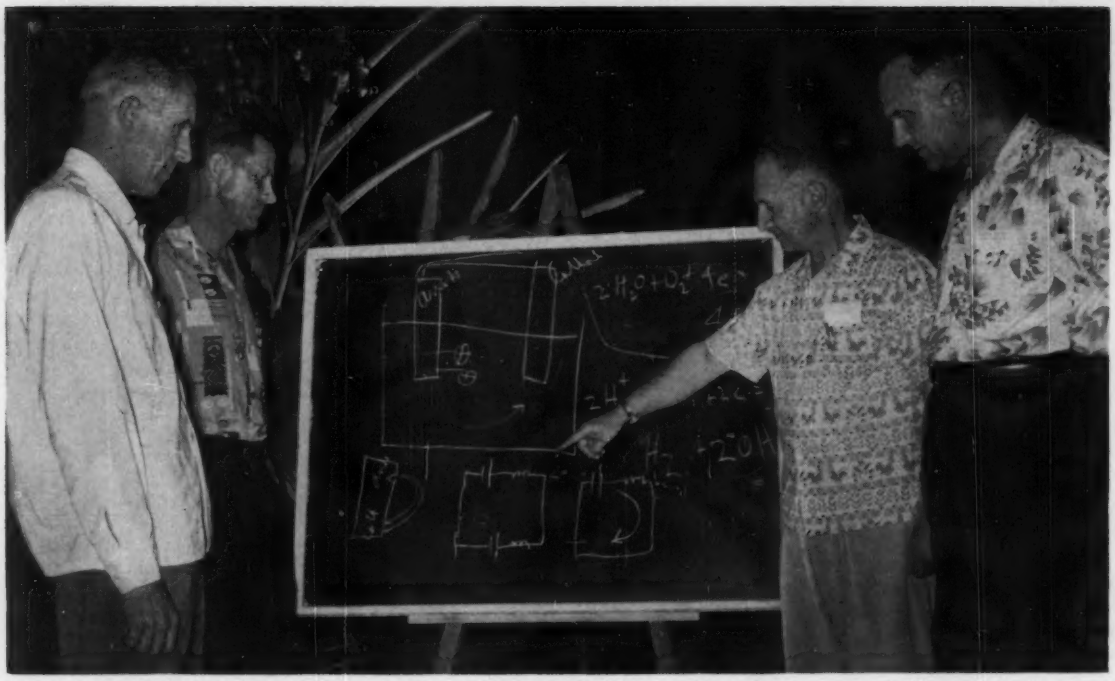
Preliminary construction begins soon on portions of Alabama Power Co's $100-million Coosa River hydro development following board of directors acceptance of FPC's license.

Chelan County PUD has signed contracts for sale of its Rocky Reach Dam's 775-Mw output. Puget Sound Power & Light Co will take 50%; Alcoa, 23%; Portland General Electric, 16%; Pacific Power & Light Co, 7.1%; and Washington Water Power Co, 3.9%. The contracts clear the way for financing of the $270-million project.

Relocation Opposition

The efforts of utilities to gain reimbursement for costs of moving their lines has drawn the ire of Arthur C. Butler, National Highway Users Conference director. He told a Kentucky chapter the line relocations would drain off $2 billion of funds alloted for the federal highway program.

Bills for reimbursement were introduced in 39 state legislatures last year, Butler said. Sixteen states passed laws for some form of repayment.



DR E. W. GREENFIELD, Kaiser Aluminum & Chemical Corp, discusses aluminum conductor corrosion with H. E. Jung, Southern California Edison, C. H. Williams, Hawaiian Electric, and Harold Zamzow, Line Materials, at Honolulu, H. I.

Get into Nuclear-Power 'Act'

Pacific Coast Electrical Association is told by Middle South's Hallingby, citing threat of public-power gobble

Four-tenths of one percent of operating revenue should be the minimum contribution of each private utility to nuclear power programs. This benchmark is quoted with ever-increasing frequency, Paul Hallingby, Jr., vice president, Middle South Utilities, told the recent Hawaiian Conference of the Pacific Coast Electrical Association.

Hallingby stressed the need for all utilities to participate, thus saturating the nuclear power program with private effort and pre-empting extensive federal participation. He warned of the consequences of further public power encroachment on the utility field if the advocates can use federal financing of nuclear technology advances as an excuse.

Utilities not yet participating should "get in the act" with enthusiasm, Hallingby continued. He suggested providing research and development funds for promising reactor designs not yet at the full-scale demonstration stage as an avenue open to many companies not yet committed. The AEC staff will approve of this general approach, Hallingby assured.

Eighty electric companies now are participating in development and construction of 14 nuclear power projects and one thermonuclear research project. Additionally, a large number are active members of nuclear power research and study groups, reported Edwin Vennard, managing director, EEI.

Utilities Told 'Apply Resources'

The industry's policy, he continued, is that its resources should be utilized to the maximum extent, thereby enabling government expenditures to be held to a minimum. Vennard lauded progress made as substantial evidence of the industry's determination to help bring about economically competitive nuclear power.

Utility rates will still be low 20 years hence, despite much higher operating costs and continued erosion of the dollar. This will be possible because of great continuing improvements in electrical apparatus, according to Gwilym A. Price, president and chairman, Westinghouse Electric Corp. Crystal-balling the industry of the future, Price predicted 1977's typical modern home would include appliances to dust woodwork electrostatically, wash clothing ultrasonically, refrigerate by the Peltier effect, and handle foods automatically from freezer racks through the cooking process to the table.

Outages due to conductor burn-down no longer can be tolerated as customer density increases and demands for improved service continuity continue, said H. T. Zamzow, Line Material Industries. Unfortunately, more testing is required before burn-down characteristics of covered conductor are known with sufficient precision for most economical design. Such tests are scheduled at several utilities this

year, he reported, but meanwhile conservative design requires the assumption that minimum conductor damage occurs when faults are minimized by the fastest protective devices. Zamzow recommended the modern 2½-cycle power-class recloser as an economical approach.

Southern California Edison Co is testing special high-strength all-aluminum conductors and aluminized steel-core conductors for distribution, according to H. E. Jung. But Edison is still learning about conventional ACSR, first used on distribution in 1951 as dictated by economic necessity, he said. By 1956 all Edison distribution farther than 1 mile from the sea had gone over to ACSR and AAC.

Inhibitor Protects Al-Cu Joints

Splice troubles have been overcome gradually, Jung stated. Controlled tests on pre-greased conductors showed excellent corrosion inhibiting. Edison has depended on thorough cleaning and adequate application of inhibitors for copper-aluminum connections and has had little trouble with cold flow.

Aluminum conductors are receiving extensive weathering tests on the windward side of four islands in the Hawaiian chain. The tests, now in their second year, are conducted by Kaiser Aluminum & Chemical Corp in cooperation with Hawaiian utilities, said Dr. E. W. Greenfield. Results are being corollated with conductor weathering tests on the mainland. Greenfield noted AAC and AAAC conductors apparently show little weathering effect so far, but core-type conductors, when unprotected by greases, show definite attack by oxidation. Insulated secondaries and service conductors, as well as bare conductors, are being appraised, and accessories and poleline hardware are receiving attention.

Taxes paid by ultilities, when equitably applied, are passed on to customers commensurate with ability to pay. All that tax-paying utilities ask, said W. T. Lucking, president, Arizona Public Service Co, is identical tax treatment for all utilities, public and private. Lucking emphasized that he was directing his comments at public agencies who derive benefits from taxes levied on other utilities' customers.

The California Legislature has resolved to examine all proposed laws relating to business, industry, and agriculture to determine their effect upon the business climate in the state. This action was cited by C. C. Walker, vice president, General Electric Co, as an example of an enlightened lawmaking approach to the problem of business restrictions. Walker urged utility participation in business-sponsored organizations to further a better business climate.

One quarter of all the power companies now have special area-development departments and programs, and this subject is assuming ever-greater importance. Probably the most important facet of area development is the upgrading of existing industries, according to C. W. Leihy, editor, Electrical West. This can have greater effect in creating a broad economic base than attempts to bring new industries into an area. The utility should spearhead planning and growth activities in its service area, Leihy emphasized, because it is inextricably tied to the area.

Industry-wide promotions like Live Better . . . Electrically are made possible by steady growth and increasing efficiency of mass advertising media, M. E. Skinner, Union Electric Co vice president, told the meeting. With door-to-door selling priced-out by inflation, the advent of national promotions is most timely, he said. He placed a high value on their syndication of sales aids, providing high-quality material at low cost to users.

The contractor is the key to the Housepower Program, but he's not in the program as much as he should be, according to H. R. Stevenson, Detroit Edison Co. To spur his interest, Detroit Edison instituted its Housepower Forum program, which furnishes non-technical, university, and business instructors. Contractors, shown how they stand to gain by program participation, reacted enthusiastically. Many have reported boosted rewiring sales.

Use of "advertising leaders" by franchised appliance dealers was urged by G. T. Bogard, GE, to prevent discounters from establishing fixed-price differentials in the public mind.

System Planners Advised on Getting Most from Computer

A utility gets the biggest engineering assist from its computer by setting up a full-time specialist group within its engineering organization. This group would consist of those experienced in power system planning, engineering, and operation, and trained in machine computation. Individually, they would be electrical and mechanical engineers and mathematicians.

The company's engineering department, not the computer group, would originate the problems to be converted to computer solution. These engineers would also have some training in computer applications of engineering problems.

This organizational arrangement was proposed by A. P. Fugill, chief electrical engineer, planning and project engineering department, Detroit Edison Co. He spoke before the System Planning Committee of Pennsylvania Electric Association at its Nov. 7-8 meeting at Schenectady.

Discussion of Fugill's talk disclosed that many companies assign the computer to the accounting department and lend it part-time to the engineers. But then the engineers, who originate the problems for computer solution, do not have computer training and the computer specialists, who program the problem, do not have engineering experience. Fugill's proposal is designed to bypass this communications barrier.

Fugill also advised that the computer group be supervised by a strong person with ability to sell his ideas over opposition. He should be experienced in computers and utility engineering and he must have the full support of top management and the authority to carry out his responsibilities.

Industrial Safety Must Be Planned

Safety depends on equipment, system design, layout and installation, and also on general rules for operators

H. E. SPRINGER, Electrical Superintendent, Rayonier, Inc., Port Angeles, Wash.

Planning safety obviates expensive modification of an industrial plant's electrical system and equipment, such as would be prompted by an accident. Proper design, layout, and installation practices, combined with a personnel safety program spell out plant safety, especially when easy inspection and maintenance are prominent considerations.

Essential in such planning are provisions for adequate spacing, guarding for all moving parts, and enclosure of current-carrying components. These are necessary steps to general safety of equipment and persons around it. And a well planned electrical system has all susceptible components isolated from dirt, moisture, and corrosion.

Grounded-wye, low-voltage systems reduce—although they are not free of—the hazards of bodily contact. And the safety planner should be ever mindful that, although direct contact with a live part is recognized as dangerous, a component may be considered safe which in reality is partially energized through dirt, moisture, or the effects of corrosion. Rubber mats also reduce hazards.

Good practice means housing motor controls, motor-generator sets, switchgear, and load centers in clean, ventilated rooms with easy exit. There should be sufficient space for a person to move quickly and unobstructedly in the event of shock or flash.

VENTILATION in rooms and enclosures for switchgear and motor controls is necessary. Fuse failure in unventilated equipment initiated the damage shown here

Good Ventilation Essential

Ventilation in rooms or other enclosures for switchgear and motor controls should be able to dissipate inflammable or explosive gases and relieve dangerous pressures. Need for such ventilation was dramatized recently in a chemical cellulose mill.

In this mill, a 2,300-volt power fuse in a metal-clad motor-control structure developed a poor internal contact which resulted in a confined arc. The arc's heat charred the fuse cartridge and generated a combustible gas which accumulated inside the steel enclosure. When the arc broke into the open, the gas ignited and blew off the doors, side plates, and top of the poorly vented switchgear and wrecked the room. Anyone nearby would have been seriously hurt.

Many accidents are caused by unauthorized persons tampering with equipment or unintentionally entering forbidden areas. In designing and arranging electrical systems, engineers should consider providing easy access for authorized persons and difficult access for all others. Provision should be made for personnel using clamp-on transformers for taking load readings with portable instruments; their working quarters should not be congested or cluttered.

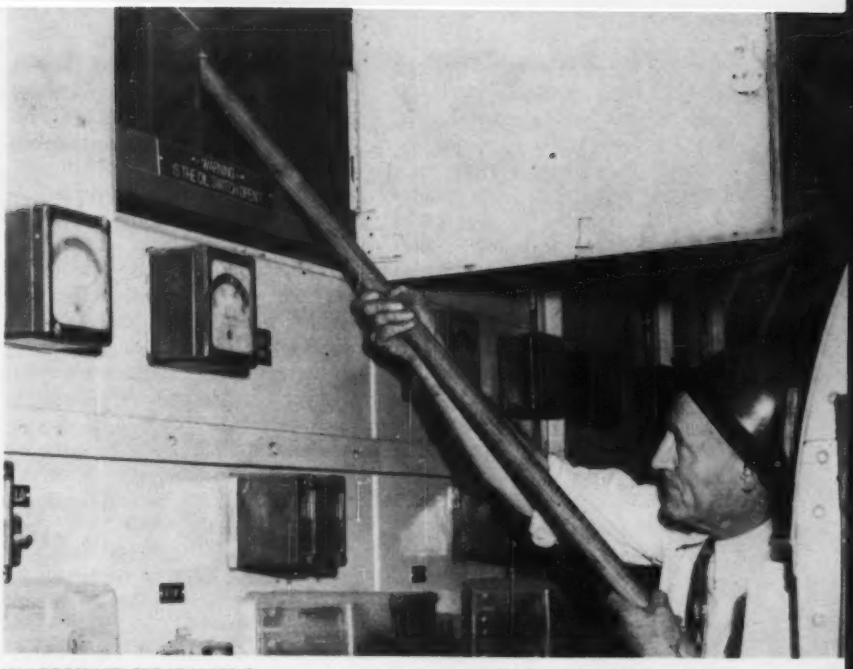
All effective safety programs include a procedure for tagging or locking out switches while men are working on circuits supplied through them. Means for locking circuits open or closed and for displaying a tagout card should be built into all switchgear and control apparatus.

Units in practically all classes of switchgear can be operated exter-

Carefully

nally. It is prudent to interlock air-break disconnects, which are not load breaked, with motor starting contactors or switches. Such interlocking prevents the disconnects from opening or closing until the motor starter is opened. Flashover injuries from faulty operation are thus avoided.

A plant incident illustrates the bliss of ignorance when all goes well. An operator on a slab barker powered by a 2,300-v motor was unable to stop it from the control pushbutton due to a jammed lift rod on an oil circuit breaker. Without realizing the hazard or calling an electrician, the department foreman drove a nail into a 3-ft stick, opened the door of the metal-clad switchgear, and pulled the bare 2,300-v disconnect with the motor running. No mishap occurred. But, the possibilities of such an act can not be overlooked; they emphasize the importance of barring unauthorized persons from some areas, interlocking switchgear, using foolproof equipment.



INADEQUATE CLEARANCE for operators may increase flash or shock hazard. Obstruction hinders man escaping from flash if disconnects open accidentally

SPACE IN FRONT of this equipment is sufficient to allow operator to move freely and swiftly. Clearances should be planned before installation

Adequate Identification Required

Modern dropout switchgear incorporates features eliminating this hazard. High-voltage starters are built with externally operated gang disconnects, interlocked with the motor starting contactor to prevent the disconnects from being opened under load. They enable operators to perform their own tagout operations safely, even when large, high-voltage motors are involved. Low-voltage circuit breakers or load rated disconnects serve the same end; otherwise, interlocking can make these operations safe.

Adequate identification, often left to installers and operators, should be given equal attention by system designers. It is extremely important that the entire system be completely identified. Markings should be as indestructible as possible, firmly fastened, and easily interpreted and followed. Identification of switchgear and control apparatus and all important components in them should be taken care of in the design and fabrication process.

Further identification after installation, often overlooked or incomplete, is equally or more important. It should cover power and light feeders, switchgear, motor starting apparatus, control stations, and all driven equipment. The identification should leave no room for doubt in the mind of a man pushing buttons, working on driven equipment, or on current-carrying parts supposedly de-energized.

Small portable engraving machines are a good investment where numerous identification plates are needed. Tags can be made on the job and tailored to suit needs. Phenolic resin plates with colored sandwich layers are excellent for making permanent identification and are available in sheets or cut to size at low cost.

A complete unbroken grounding system with grounds close enough to prevent dangerous potentials on any part is essential. Piping and building structures are not dependable because of the chance of opening ground circuits and the uncertainty of maintenance. Nor are conduit systems entirely safe unless maintained and engineered for that purpose.

Grounding should extend to all portable apparatus, cranes, shop machines, and welding operations. Many times wires have burned inside a conduit furnishing a stray path for welding currents due to improper grounding. Because parallel paths to ground from traveling cranes often direct leakage current through the cable and hook to the hook tender standing on a grounded surface, crane rails and frames must be particularly well grounded. It is good practice to install a separate grounding trolley and not depend entirely on the rail contact.

Overhead lines must be kept above crane booms, well out of reach of accidental contact by men working on roofs, walls, towers, or tanks.

Safety Is Engineers' Responsibility

Personnel safety measures include education, safety rules, inculcating personal safety habits and safe operating procedures, and plant policies. They are largely the responsibility of operating and maintenance engineers.

Although rigid safety rules are highly important, their effectiveness and enforcement depends on employee acceptance. They must be reasonable and understandable. To make them understandable, the educational program should employ meetings, films, exhibits, and demonstrations.

Rigid, strictly enforced tagout rules and a follow-up procedure assure obedience. Attention must be given to the habitual chance-taker who prefers to test a circuit by grounding it with a screwdriver or "saves time" by failing to tag a switch before climbing into a fan.

Tagouts and clearances should be restricted to qualified personnel. Tagout cards should be filled out completely and in a manner assuring positive and complete clearance for all involved. Methods of clearing a circuit or machine should be specifically stated and should be such as to create full confidence in them.

Tagout rules are meaningless unless personnel understand the reasons for them. The danger is often not apparent. Lack of understanding of the dangers underlies many rule violations so that employees must be made aware of the reasons for the rules. Frequent reviews acquaint new help with the rules.

Non-conducting safety hats are essential around control apparatus. Metal hats are a definite hazard around power lines and inside metal-clad switchgear or control structures. Metal ladders are unsafe for work on lighting or other high circuits.

Because portable electric tools are so widely used, frequent instruction in proper handling is advisable. Serious shocks in hazardous places can be avoided by plugging the cord in before handling the tool and by picking up the tools so that the user can let go safely when he receives a shock. Cords and connectors should not be laid where they are subject to water or abuse. All defects should be repaired immediately.

A few simple precautions are necessary for welding operations. Torch flames should be directed away from motor windings, wiring, and control apparatus, as should water for spark fires and cooling. The importance of seeking proper ground current paths for welding can not be overstated.

Include All Workers in Program

Educational programs should extend in some measure to all operating personnel. Such personnel should be cautioned not to tamper with electrical apparatus, to stay out of posted areas, to keep hoses away from motors and other vulnerable apparatus, and to avoid blocking pushbuttons with wedges, plugging overload relays, changing energized lamps, or allowing shocks to go unreported.

Most people want to work safely and are willing to follow the rules as far as they understand them. A few require more persuasive measures. Engineers who help formulate and direct safety programs must gear them to both needs.

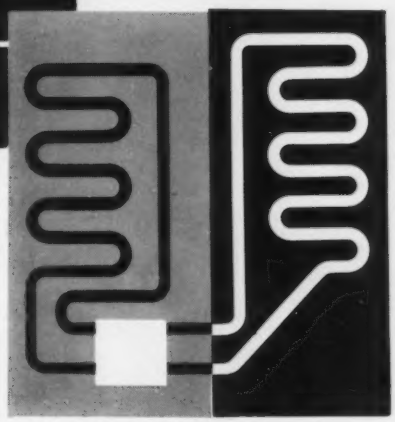
Some consideration must be given to the general public safety. This includes provision for proper enclosures and warning signs, isolation of open bus structures or control panels, restricted areas, locks, and supervision of visitor tours. Occasionally a curious tourist will wander into a substation or other forbidden area. Clean-up men can do much damage to electrical equipment with water or air hoses.

Drilling in concrete where conduits are concealed should be subject to engineering department approval. Riggers and dock workers have been known to contact underdock trolleys, often with disasterous results, when a steel sling carried over the shoulder or dragged across a crane falls into a trolley duct.

Changing a lamp bulb seems simple. It is, until one shatters when touched with wet hands and leaves the live filament dangling. It is advisable to confine bulb-changing to a maintenance man assigned to the particular duty. It is always safer to unplug portable cords first.

TAGOUT CARD, properly filled out and cleared, gives workers on equipment and circuits complete security. Card at right is incomplete, hence no security

AN ELECTRICAL WORLD SPECIAL REPORT

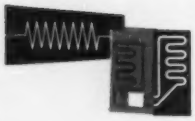


Electric Space Heating 1957:

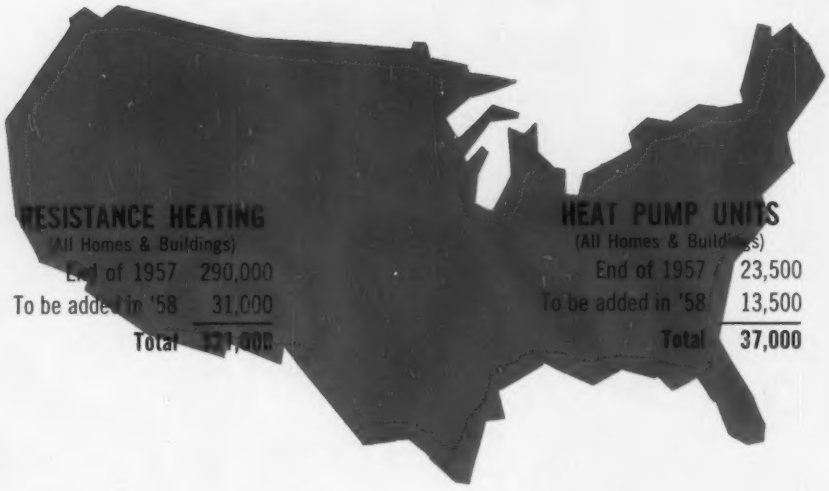
- It looks like the 'load of the future' as summer peaks and air conditioning loads rise and promise to keep on rising.
- Geography and weather are becoming less important in utility eyes. They are turning more to good design and insulation to hold down customer costs
- Rates are important, but not the sole determining factor. Although most promoting companies sell at 1 ½¢ or less, many jobs at high rate go in on basis of convenience, prestige and other intangible customer benefits
- Narrowing gap between kwhr and competing fuel costs points to a swing in the 'balance of costs' toward more favorable position for electricity
- New methods, tables for calculating heat loss and energy use

T. R. JORDAN
Commercial Editor

Details of these and other EW survey findings on following 15 pages



Electric Space Heating



There are approximately 290,000 completely electrically heated homes and buildings in the United States as of the end of 1957.

Add to this another 23,500 heat pumps in residences and commercial-industrial buildings.

During 1958, utilities can expect to add something like 31,000 resistance heating installations and 13,500 heat pumps.

These are the main findings of Electrical World's 1957 Electric Space Heating Survey.

These 1957 figures fall slightly short of those predicted in last year's survey (EW, Jan. 21, 1957, p 71). Main reasons for the discrepancies:

- The drop in new home starts, which, in some areas, are off from last year as much as 40%.
- Tight money. Although not a first cause in the new-home drop off, it has compounded and worsened it and has had an obvious slowing effect on most other aspects of the economy as well.

In spite of these difficulties, electric space heating still holds the greatest promise as a utility load builder and balancer. The reasons are not hard to find:

The summer peak situation is not easing off. Although a higher percentage of heat-promoting utilities said they had winter peaks (60% this year compared to 55% for '56), many of the non-promoting utilities indicated a change to summer peaks, or a lessening of the ratio between their winter and summer demand. If they were not planning definitely to promote electric heating, some said they are considering it.

The steady decline in annual load factor since the late 1950's has utility execs looking hopefully toward electric heating to reverse the trend . . . or at least slow it down.

There are other headaches, too, that electric heating may help ease. Residential growth rate has slackened considerably in the past year and a half. Drop in home starts gets the biggest share of the blame, but factors related to existing dwellings come in for it too. Examples: high appliance saturation areas with "no place to go," and the drop in appliances' share of spendable income. One utility exec's Rx: "I submit that only through the sale of heat pumps and electric home heating will our industry ever realize its much publicized goal of 10,000 kwhr use per average customer."

Electrically Heated Buildings Up 7.5%

Electrically heated homes and buildings are up about 20,000 installations since the end of 1956. This is a gain of about 7.5% over last year's 270,000. The breakdown here is roughly 9:1 in favor of homes. This means that about 18,000 completely electrically heated homes went on the lines in 1957. They represent something between 2 and 3% of the total units built. The proportion is about the same as that projected for '57 in last year's survey, even though total figures are less. This could well mean that electrical heating is holding its own in a tough, competitive market.

On the basis of what surveyed utilities said they expect to put on their lines during 1958, the coming

1957: Anatomy of a Promise

Electrical World's 1957 Electric Space Heating survey breaks down what still looks like the most promising residential load builder and balancer despite the drop in new home starts, tight money and economy slowdown

year's resistance electric heating scoreboard goes something like this:

Total number of completely electrically heated buildings will be about 31,000. Of these, something between 27,000 and 28,000 will be in homes; the balance in stores, offices, schools and other commercial and industrial structures. This will bring the total number of resistance heated buildings to more than 320,000 by the end of '58. About 112,000 will be on investor-owned utility lines. The rest will be served by public agencies—the municipals, public power districts, and electric cooperatives.

This year's findings confirmed what last year's survey pointed out; namely, that electric house heating is no longer limited to the South. A national picture seems to give the South a preponderance of the load because of the high saturation in the Tennessee market. Actually, the volume of electric resistance heating going on Northern and Southern company lines is about the same.

Power companies with the largest number of electrically heated homes are:

- California Oregon Power—14,000
- Pacific Gas & Electric—13,800
- Portland General Electric—28,000

Publicly-owned high scoring utilities are:

- Electric Power Board of Chattanooga—25,400
- Knoxville Utilities Board—16,500
- Nashville Electric Service—30,000

The Survey Covered:

100 electric utilities representing approximately 33 million meters, or 61% of the national total

Breakdown of these utilities:

94 are investor-owned utilities
6 are large municipal systems or public power districts

Among the investor-owned companies:

31 now promote resistance equipment for complete space heating
16 either plan to promote in '58, or are considering it
40 now promote heat pumps
18 either plan to in '58 or answered 'maybe'

Among the municipals and public power districts:

1 now promotes complete resistance heating
1 plans to in '58 and another is considering it
3 now promote the heat pump
2 are considering promoting heat pumps

Heat Pump Growth in Line With Predictions, South

'Vital Statistics' of Heat-Promoting Utilities

'Straight Electrics' Predominate

Straight Electrics	82%
Combinations	18%

Majority Have Winter Peaks

Winter Peaks	60%
Summer Peaks	40%

Almost ¾ths North of 4,000 Degree-Day Line

North	72%
South	28%

More Than ½ Have Improved Load Factors

Increased LF Since 1950	58%
Decreased LF Since 1950	36%
LF Remained the Same	6%

But the outstanding electric heating job is still Southern Nevada Power Co's. With total meters at about 30,000, it claims to have 20,000 all-electrically heated buildings. Saturation, 66.6%!

Heat Pump Statistics

There were approximately 10,500 heat pumps sold during 1957. This brings the total number in use to about 23,500, pretty much in line with last year's predictions. About 62% of these are in homes, the remaining 38% in commercial and industrial buildings.

Investor-owned utilities fare much better with heat pumps than they do with resistance heating. As of this writing, they have almost 90% of the installed total.

While the balance in the number of resistance heating units may be shifting from the South to the North, Dixie is still 'way ahead when heat pumps are counted. Of the nation's 23,500 units, 18,000 are below the 4,000 degree-day line, or 3¼ times as many below as above it.

Florida Power Corp is the country's undisputed champ in the number of heat pumps on its lines. It had more than 3,500 at the end of 1956, and has added another 2,600 during 1957. (FPC's heat pump count central units and reverse-cycle room air conditioners.)

Forty three utilities reported they promote heat pumps. Another 20 plan to do so in '58 or are considering it. Yet concentration of heat pumps is on the lines of relatively few utilities. Pacific Gas & Electric (a combination company, incidentally, that promotes both gas and electricity and lets the chips fall where they may) has an estimated 1,200. It expects to add something like 750 more during 1958. The American Gas & Electric System, a long-time electric heating promotor now numbers almost 1,100 heat pumps in service, with 400-500 to be added during 1958.

Percentage of Promotors Stays Steady

About the same percentage of power companies in this year's study say they promote heat pumps as in last: 43% in '57, and 41% in '56. Furthermore, the same utilities which promote the heat pump also push resistance heating. There are, however, exceptions. Tampa Electric is a notable one. Reason: the company still has a winter peak, and promotion dollars go into summer air conditioning. Therefore, the heat pump is pushed rather than resistance heating. Yet Tampa Electric—with about 130,000 meters—reported more than 2,600 all-electric heating customers on its lines, and expects 1,000 more to be added in 1958.

What are the vital statistics of the heat-promoting utility? The study shows:

- Four out of five are "straight electrics" (82% straight electric; 18% combinations).
- Three out of five have winter peaks. Ratio is exactly 60-40, in favor of the winter peaks. However, many winter-peak utilities are anticipating the swing to summer peaks.

Is Still Ahead

Cornerstones of Promoter's Heating Programs

- LOAD STUDIES—79% have made load studies of resistance heating on their systems
- HEATING DEP'T—85% have special electric heating departments
- TRADE—91% work with their trade allies
- BUDGET BILLING—64% use budget billing for promotion
- LAYOUTS 67% provide help layout heating jobs; another 9% plan to
- INSULATION—100% make insulation recommendations; 24% have requirements
- FLOOR DISPLAYS—85% devote office or window space to electric heating displays
- POLICY—88% have definite policies for employees, trade allies and customers

• Almost three-fourths are north of the 4,000 degree-day line.

• More than half have upped their load factors since 1950 (58%).

Gas and Oil Competition Tough

Competition for the promoting company is tough, too. Almost nine out of every ten face competition from natural gas; and over three fourths have to contend with the No. 2-oilmen in their areas. Natural gas rates, among all utilities reporting it for their areas, vary between 55¢ and 75¢ per mcf. No. 2 fuel oil sells for about 15.5¢ per gal. A sizeable number (31%) sells against gas above the 75¢ per mcf range, and 19% sell it against gas below 55¢.

As to be expected, heat promoting companies are rate conscious. A rundown on their rates reflect it. Almost half (45.5%) sell the kwhr for less than a cent and a half. Almost one fourth peddle it somewhere above 1½¢ but less than 2¢. The same number (23%) sell at exactly 2¢, and less than a tenth (8.5%) go above 2¢. This backs up recent comments of some Indiana electric co-op men. Their slogan: "Two cents competes, but 1½¢ converts."

So far as the promoting utility is concerned, the residential demand charge has virtually gone out the window. Seven out of ten do not have it. Of the remaining 30% who do, it is set for most of them above 7 kw. Even among these, demand charges are generally liberal.

Survey questions concerning load factor pointed up some interesting aspects of heat promoting utilities. Almost three out of five (58%) have increased load factors since 1950. Thirty-six per cent have had the LF go down, and a small 6% had it remain about the same.

Companies having winter peaks generally had higher load factors than those having summer peaks. Average of winter peak companies was 64.2%; of summer peaks companies 58.3%. Furthermore, there were twice as many promoting winter-peak companies with load factors above 60% as there were summer companies. All but three of the utilities with decreasing load factors had summer peaks in the past year. Oddly, it was a winter peak company, though, that registered the largest load factor drop since 1950—13.4%.

What about the details of a promotion program? How do the utilities involved in pushing electric heating and/or heat pumps go about the business of putting it on their lines? Based on the study, and capsuled in the box on this page, the typical program is probably set up something like this:

When the associated symptoms of summer peak and dropping load factor have been around long enough to appraise their permanency and direction, the utility executives decide that electric heating may be a possible answer to some of their problems.

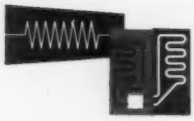
Steps in Electric Heating Program

Accordingly, a **load study** of the effect of electric heating on the system load is made. Among the 100 responding utilities in this year's survey, 79 have done this or plan to. On the basis of the study findings, it is decided whether or not to go ahead with electric heating promotion.

The next step is to set up a **separate department to handle the space heating operations.** 85% of the promoting companies have done this.

That department then needs a framework within which to operate. This is provided by a policy—**an electric heating policy**—for customers, trade allies, and customers. Almost 90% of the promoting utilities have promulgated such a policy or policies. Kansas Gas & Electric and Union Electric Co, two recent electric heat promotors, have established this policy very carefully and formally (see p 110).

Once policy is established, utilities go on to implement it in several general areas. 91% **work with the trade allies** in setting down what kinds of electric heating equipment are best under given conditions, what best suits customers' needs. Some 67% either do **layout**



Promoting Utilities Use These Media

	% of Utilities Which Use Media	
	Resistance Heating	Heat Pumps
Newspapers	76	64
Radio	55	49
Television	40	45
Billboards	21	21
Handout literature at locals local home shows, etc.	94	76
Car Cards	6	12
Truck Cards	18	15
NEMA Slide Film	33	—
Personal Calls	91	79
Direct Mail	67	70

work for the customer or provide assistance to do so. All promoting utilities make insulation recommendations; and 24% have insulation requirements. As regards promotion, 85% devote floor or office space to **electric heating and heat pump displays,** 91% try **budget billing,** usually on a 10- or 11-month basis with the last month used to square accounts. All utilities use various mass information media of one kind or another. A detailed breakdown of their media activities is discussed elsewhere in this report.

Most Utilities Want Insulation

Regarding insulation standards or recommendations, by far the largest group of utilities want customers to put in the regular 6-4-2 combination, i.e., 6 in. in ceilings, 4 in. in walls, and 2 in. in uninsulated floors. Many modify these conditions for existing homes, but add that where they can be met at reasonable cost, it should be done. As to kinds of insulation, almost all companies indicated mineral wool or its equivalent. When actually asked for their preference however, very few allowed themselves to be tied down. Said one company executive: "We don't want to start any fights with insulation people in our area. We're for anything that'll do the job well." Although not specifically asked, about a third of the companies indicated the desirability of vapor barriers, usually in ceilings and uninsulated floors.

Surprisingly, a quarter (24%) of the promotors do have insulation *requirements.* Several of these utilities have gotten on the electric heating bandwagon only within the last year or two. Their reasoning: It's necessary to protect the program in its infancy. None want their heating jobs to get bad names for fear it will cripple future efforts and results. Says Kansas G&E's general sales manager K. M. LaRue, "We are quite insistent on good insulation and even go so far as to discourage electric heating in the event the customer does not insulate to our specs."

Another point on installation and application techniques covered was thermostat regulation. Slightly more than 88% say they recommend a thermostat in each room. Of these, 68% place no kw limit on the thermostat. Only 13% prefer the 5-kw limit. The balance of utilities scatter their recommendations fairly evenly between the 4 and 3-kw limits.

Budget billing findings also line up with and extend practices reported last year. 64% of the promotors use it. Most do it on a 10-month basis. Some report they purposely try to overestimate the monthly charge in order to give the customer a refund when adjustment time comes. Reports one utility heating man: "Budget billing does two good things. It allows the customer to set up a year's heating bill on a known monthly basis, and it makes him feel good when he gets a refund. This is good for the company. But, another cautions: "Set your monthly charges carefully after inspecting

the job. If it's a bad one, and the charges are going to be high, budget billing can backfire when the customer is slapped with a big adjustment."

What media do utilities use in the heating promotion campaigns? Just about all, according to survey returns. But some are more popular than others (see page opposite). Handout literature at local home shows, state fairs, etc., leads the parade; 94% of promoting utilities use it for resistance heating and a shade more than three fourths employ it to push heat pumps. Personal calls come next (91% for resistance heating, 79% for heat pumps). Newspapers and direct mail run neck and neck for third place with 76% and 67%, respectively. About half use radio and television, with radio ahead by about 10%. Only a handful (6%) use car cards, and about twice that many employ truck-side cards. The NEMA slide film is used by about a third for resistance promotion.

Special heating rates are another inducement used by some utilities. About a fifth of the promoting companies reported they made rate changes within the past year that would affect their electric space heating businesses. All these changes were in favor of electric heating. One big municipal dropped its residential demand to measure the effect on system peak. Result: an expected slight decrease in revenue, but no apppreciable increase in demand.

What about non-promoting utilities? What does the survey reveal about them? Of the 53 electric utilities who don't promote and do not plan to, 47 or almost 89% are above the 4,000 degree-day line. All but one of these has a winter peak. More than twice as many experienced dropping load factors as those who have had rising ones. 70% are "straight electrics".

Municipal, Public Power Activities

Just how active in electric heating are the big municipals and public power districts? Survey results say that, as a group, they are more active than investor-owned utilities. Nashville leads the nation, according to the survey, in number of electrically heated homes. It reports close to 30,000. The Electric Power Board of Chattanooga has almost 27,000 and Knoxville tallys close to 17,000. Other large municipals include Tacoma City Light, Memphis Light, Gas, and Water Division, and Sacramento Municipal Utility District. All these are well over the 1,000 electrically-heated homes mark.

Because of its heavy concentration of electric heating, the Tennessee Valley area makes up such a big part of the national picture. Developments there are of considerable interest. In the Valley the number of homes using electric heating is "rapidly approaching the 200,000 mark," according to B. H. Martin, TVA's Commercial and Industrial Power Section chief. Continues Martin: "Our most recent estimate indicates over 177,000 homes with complete electric heating systems. This represents a saturation of about 14%." Most homes, as would be expected, had their electric heating systems put in when they were built. As with investor-owned companies, the recommendation for electric heating for existing homes includes specs for insulation.

Martin expects the demand for summer cooling to affect sales of central systems because these systems will have to provide functions other than merely controlling air temperature: namely, humidity control and air purification or cleaning. Then he pointed to heat pumps. "The heat pump for year-round air conditioning will certainly become more generally used in the larger and more expensive homes. Any modern home, however, for which air conditioning is contemplated is a logical prospect for a heat pump installation, no matter what its size."

But the Tennessee Valley is not the only area in which the municipals and co-ops are active in electric heating. Heavy promotion and concentration are to be found in the Pacific Northwest and in parts of the Southwest.

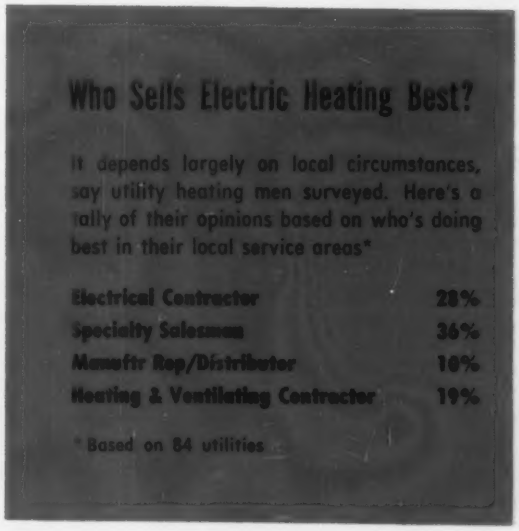
Rate-wise the municipals and co-ops stack up something like this: the range is from 2¢ a kwhr on the high side to a low of 4 mils. Lowest rates are in the TVA area. Of the six reporting municipals and public power districts, all have rates below 1½¢. Four are below the 4,000 degree-day line; and all but one has a winter peak.

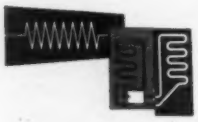
Heat Pump Market not Dominated

Municipals and public power districts do not dominate the heat pump market as they do that for resistance heating. Although they have more than ⅔ the market for the latter, they cannot claim anymore than about 10% of the former. Two reasons for this:

- The Tennessee and Pacific Northwest markets do not have a big demand for summer cooling.
- Many co-ops, serving a rural load which makes of large part of their total load, serve heavy summer irrigation demands. Therefore, they go light on summer air conditioning loads.

Who sells electric heating best? Who outside the utility, that is? It depends on local setups say surveyed utilitymen. But in any given set of circumstances, it's the specialty salesman—the one with electric heating training—who is likely to do the best job. So said 36% of the utilities questioned. Their second choice: the electrical contractor by 28%. The heating and


Who Sells Electric Heating Best?
It depends largely on local circumstances, say utility heating men surveyed. Here's a tally of their opinions based on who's doing best in their local service areas*
Electrical Contractor 28%
Specialty Salesman 36%
Manufr Rep/Distributor 10%
Heating & Ventilating Contractor 19%
* Based on 84 utilities



Heating Rates of Promoting Companies

ventilating contractor can do it best, according to 19%; and 10% went to the trouble of writing in the electrical distributor or manufacturer's representative, although it did not appear on the survey form. One popular concensus: no matter who sells the equipment he should also handle the necessary thermal insulation. Idea is to enable the customer to buy the job in a package. If the dealer doesn't want the insulation line, he should make an arrangement with a separate insulation dealer, so that the result to the customer is the same. American Gas & Electric has been highly successful in encouraging their equipment dealers along these lines.

How They Figure Heat Loss

How do utilities calculate heat losses for electric heating jobs? Most seem to prefer the American Society of Heating and Air Conditioning Engineers' method. Of the 100 utilities asked, 56 said they used this system. NEMA's manual was the second most preferred way, some 33 utilities using it. A few (5) use some sort of rule-of-thumb method. Most electric space heating manufacturers supply catalogs on heat loss calculations to be used with their equipment; 16 utilities use these. The National Warm Air Assn. manual is the bible for only nine. Nineteen companies use more than one method, depending on the nature of the job.

One market not covered in the survey, but of growing interest to the nation's utilitymen and manufacturers is that of schools. (EW, Nov. 18, 1957, p 100). Until a few years ago, electric school heating was not given serious consideration by power suppliers or school boards. Summer peaks have changed this. Electrically heated schools, an off-daily peak, wintertime load is beginning to look attractive to utilities.

As in other electric space heating and heat pump markets, American Gas & Electric has also been a pioneer in putting electric heaters in classrooms.

Starting with one school on its lines in 1955, AG&E now has a school heating scoreboard that racks up like this:

As of the end of October, 1957, 22 electrically heated schools were sold. Of these:

- Seven are in operation.
- Ten are under construction.
- Five are sold, but not yet under construction.

In addition, AG&E has 34 more school prospects that are in the talking and biding stage.

But selling electrically heated schools is not all a bed of roses. Cautions AG&E's commercial manager E. A. "Al" Snyder: "Selling electric heating to schools is tough selling. It's tough because you have to deal with a group of customers, rather than a single one. This is the local school board. To make matters worse, one of its members may be a competitor."

Electric school heating is making good progress in the Pacific Northwest. Says Westinghouse Electric's

S. L. Forsyth, manager of Electric Heating for Homes Division: "The school heating market is really opening up there (the Northwest). We consider it one of the most promising markets we've seen in a long time. Once the electric heating story is told to school boards, and they see the potential savings in construction costs and related costs, they begin to consider it seriously."

Manufacturers' Views

What do the manufacturers of electric heating equipment and heat pumps think of the situation? Last year, their remarks at the Electrical World Electric Space Heating and Heat Pump Conference were reported. This year EW made a spot check of opinions. Results:

• C. F. Kreiser, chairman of NEMA's Electric House Heating Equipment Section, and sales manager of Edwin L. Wiegand Co: "In general, the manufacturers of electric house heating equipment are gratified with increased equipment sales, but they are even more so with the heightened interest being shown all along the marketing chain." Kreiser gives these examples:

Contractors are more enthusiastic than ever because they are more aware of their increased return (about 250% more on an electrically heated home). This is so because the house usually has full Housepower, and this sets the stage for additional appliances.

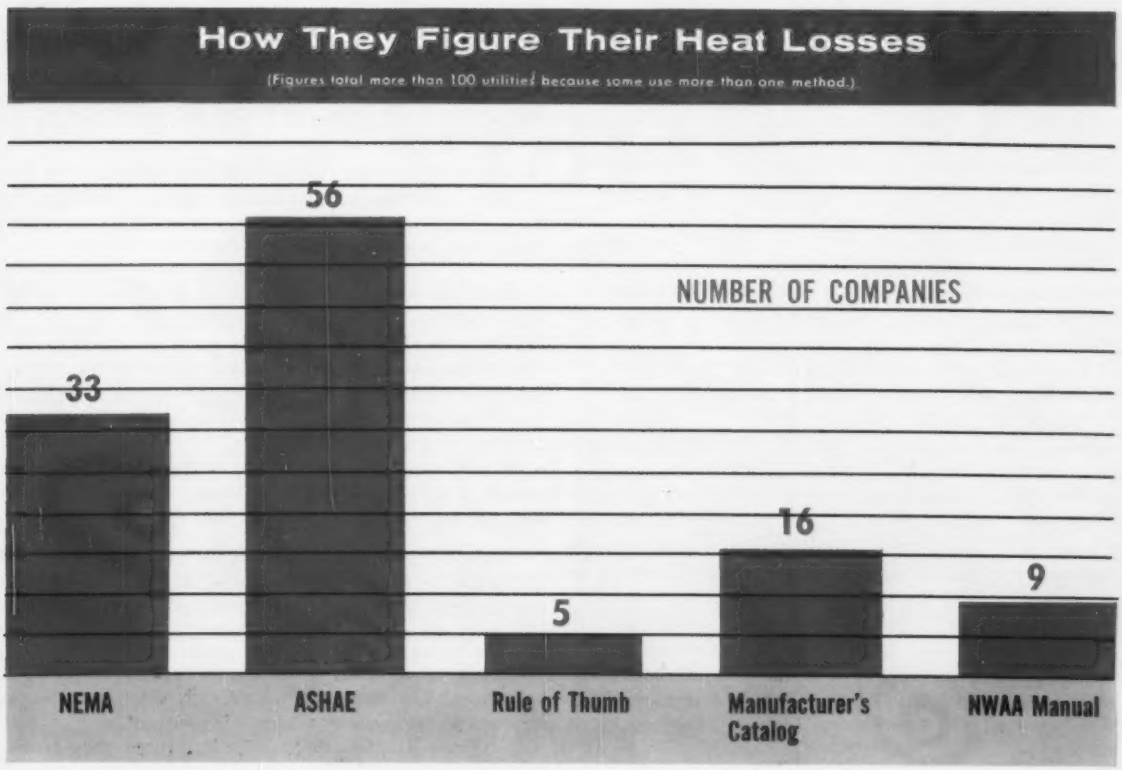
Utilities are perking up their activities. It looks as though many of them will be using Live Better Electrically's Gold Medallion Home program as a centerpiece for their electric heating and air conditioning promotional activities.

But here is the point Kreiser underscores: "The **consumer** himself is really the key once again to the future of this market. For manufacturers and utilities alike are going to have to do exactly what their customers want, and they is getting to like electric heating more and more."

Cavalier's Melvin H. Wessel backs this point up with his remarks that "The American public will not be satisfied with a modern automobile and at the same time, an out-of-date heating system. No other system begins to offer the advantages that electric heating does."

Berko's president David Knoll: cautions not to overlook the supplemental heating market. "While major attention has been focused on the complete home heating market, which has had a steadily increasing and very bright future. But the supplementary heating market has been and will continue to be a real volume producer . . .

". . . In addition, the commercial market is now beginning to open up with the demand from motels, hospitals and other business establishments. Where electric utilities have been promoting electric heat loads for over a year, the reaction has resulted in an increased demand. We are looking forward to a substantially larger volume of business in 1958."



J. B. C. **THOMAS**, Residential Sales Engineer, Hartford Electric Light Co, Hartford, Conn.

D. W. **ROSEBRUGH**, Engineer, Operating Studies; and
P. P. **DZUBAY**, Economist, Connecticut Light & Power Co, Berlin, Conn.

Now You Can Predict Energy Usage in Terms of Temperature, Wind,

Study in Hartford area also proves that heat loss of a dwelling can be calculated reliably at design temperature

Daily energy usage of an all-electric house can be predicted during the heating season in terms of temperature, wind, sunshine, sky radiation, and appliance usage.

A recent field study of the effects of these five factors in electrically heated residences has also revealed that: Temperature is the predominant factor in estimating energy usage; and heat loss at design temperature can be calculated reliably.

This study was made in an effort to establish a dependable means of predicting the effect of outside factors on heat losses or heat gains in electrically heated homes. Test data were collected from the four houses pictured above.

Heat loss calculations were made for each house using two methods: NEMA method, based on one air change per hour for infiltration; and the Simplified Tables for Hartford (pg 108), in which infiltration is accounted for by the crack-loss method.

Two recording meters in each house measured 30-min heating load and total load. Daily average energy consumption was computed, based on a day beginning at 7:00 AM, the end of off-peak water heating. Official Weather Bureau records were used to compute daily averages.

The field study disclosed the following effects of the five outside factors on electrically heated residences:

• Variations in total energy usage and in heating usage closely follow changes in temperature. This relationship is evident in Fig 1, a plot of the test data for House A, which was considered representative of the four houses.

• Wind will add to the effectiveness of cold air, but, in itself, will not increase the heat loss. However, the joint factor of wind and temperature is the principal basis for estimating heating needs.

• Sunshine had a significant effect on two houses, but apparently none on the other two. Sun may be reflected, absorbed by the surface, or transmitted into the house. Reflected energy is lost; absorbed energy has little effect on a well-insulated building; but short-wave radiation that passes through the windows is trapped by a green-house effect.

In addition, the effect of sun is greater with a lower collector temperature—for example, a cool sun porch will collect more solar energy than a heated one.

• Sky radiation may represent either a heat gain for the house, as on a bright hazy day; or a heat loss, as on a cold clear night. The main factor affecting sky radiation is cloudiness; humidity is next.

• Appliance usage undoubtedly contributes heat to the residence. The amount, however, is often difficult to determine, particularly where it is constant.

In House B, a first-floor office in a three-story house,

House A—10.6-kw Heat Loss

Description: 3-bdrm Cape Cod, basement heated (55F)
Construction: 1445 sq ft, frame, wood shingles
Insulation: Mineral wool, 6 in. ceiling, 4 in. wall, wood storm doors & windows
Occupancy: 2 adults, 2 children
Appliances: Range, refrigerator, 100-gal water heater (off-peak), washer and dryer in basement
Heating system: Glass panels, wall thermostats

House B—10.3-kw Heat Loss

Description: 3-family house, 1st floor only
Construction: 912 sq ft, frame, wood shingles
Insulation: Storm windows, warm floor and ceiling
Occupancy: 7 adults
Appliances: Fluorescent lighting, refrigerator, 5-gal water heater
Heating system: Baseboard, wall thermostats

Sun and Appliances

the principal appliance load was lighting. When daily appliance usage increased, 23% of it was reflected in lower heating consumption.

But in House A, where half of the appliance use was for hot water, the heating system did not compensate for changes in energy used by appliances. Undoubtedly much of this heat went down the drain or was tempered by mixing with cold water. Within the temperature ranges of the study, effective heat added to the house by appliances was essentially a constant value.

Equation Gives Daily Use

The test supplied data needed to formulate an equation representing daily energy usage in terms of appliance use, degree days (temperature), wind, and sun. The equation requires an additional term—the intercept, which is a constant whose value for each house depends upon the actual heat loss and the units of measurement. The equation is:

$$\text{Heating Usage} = \text{Intercept} + \text{Weather Factors} - \text{Appliance Factor}$$
$$= I + [T(1 + W) - S] - A$$

where I = intercept; T = incremental change in energy for changes in temperature with no wind; W = percent increase in T with wind speed; S = solar input; and A = portion of appliance energy that contributes to heating.

Total usage has the same formula, except that A represents the portion of appliance energy that does not contribute to heating and is added.

Values for the parameters I, T, W, S, and A are determined by a multiple correlation analysis. They

House C—7.2-kw Heat Loss

Description: 2-bedroom ranch, basement heated (50F)
Construction: 672 sq ft, frame, asbestos shingles
Insulation: Wood fiber, 6 in. ceiling, 4 in. walls, aluminum storm doors & windows
Occupancy: 1 adult
Appliances: Range, refrigerator, 80-gal, water heater (off-peak), washer in basement
Heating System: Metal panels, built-in thermostats

House D—8.6-kw Heat Loss

Description: 2-bedroom ranch, concrete slab
Construction: 720 sq ft, frame, wood shingles
Insulation: Mineral wool, 6 in. ceiling, 4 in. walls
Occupancy: 2 adults, 1 child
Appliances: Range, refrigerator, freezer, 40-gal. water heater (off-peak), kiln, washer in kitchen
Heating system: Baseboard, built-in thermostats

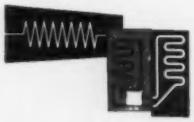


FIG 1—**VARIATIONS** in total energy usage and heating usage closely follow temperature change, as seen in this plot of data for House A

FIG 2—**TOTAL DAILY USAGE** was adjusted to an average condition reflecting sun, wind, and appliance usage. Here it is charted against daily temperature

FIG 3—**DISPERSION** of points around the regression line in Fig 2, representing residual variation in original data, is plotted with total use

FIG. 1

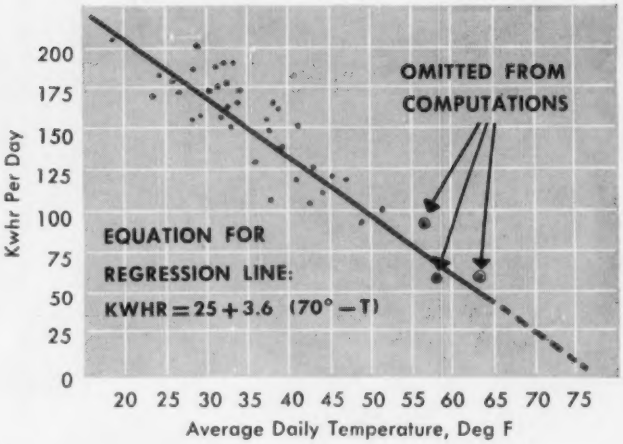


FIG. 2

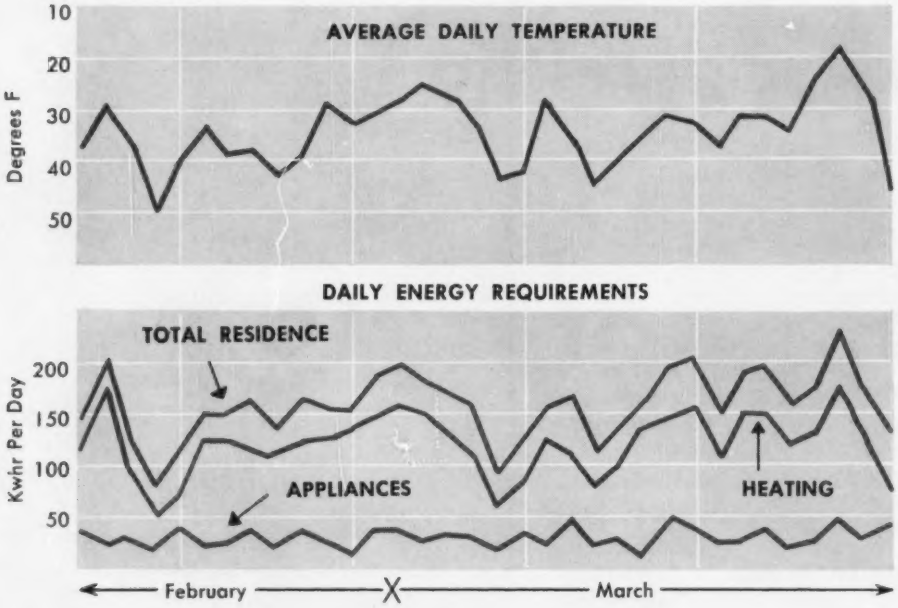
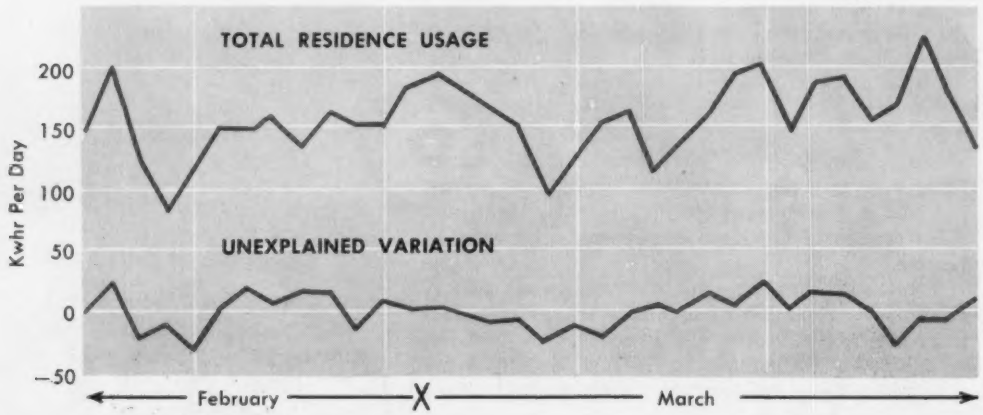


FIG. 3



are summarized in Table I.

Wind increased the coefficient, W, over a range from 0.8% for House A to 1.9% for House D for each mile per hour of velocity. Values of this coefficient at average wind speed are shown in Table II.

Actual total daily usage was adjusted to an average condition representing sun, wind, and appliance usage. This adjusted usage reflects the effect of temperature plus a remaining unexplained variation in the original data. This adjusted total daily usage is plotted against temperature, along with the regression line, on Fig 2. The slope of the line is the coefficient at average wind.

The dispersion around the regression line represents the residual variation in the original data not explained by these factors. This unexplained variation is shown on Fig 3 with total energy consumed.

The relative significance of temperature alone on energy usage can be seen (Table III) in the simple correlation coefficients for the four houses. The multiple correlation coefficients reflect the effect of all factors.

A comparison with calculated heat loss can be made by substituting design conditions (0F temperature, 15 mph wind, no sun) in the two equations for each house. Divided by 24 hr, it gives the demand at design conditions for heating and total house loads. The calculated heat loss should fall between the two values (Table IV).

Table IV shows that the NEMA method of calculating heat loss gives a consistently higher value, except for House D. There the Simplified Tables (pg 108) give a greater infiltration loss, as the house is almost entirely without storm windows. The NEMA manual, however, does not differentiate between houses with or without storm windows.

The calculated heat loss from the Simplified Tables seems quite accurate for Houses A and B. It is closer also for House C, where lower consumption reflected lower operating temperatures. But at House D, which used a load-limiting device, the low energy use is difficult to explain. It seems unlikely that the load limiter, designed to minimize demand in this house, would affect consumption. But there is no other explanation for the low usage.

TABLE I—How to Use Equations for Computing Heating Usage

Heating Usage = Intercept − Weather Factors − Appliance Factor
Heating Usage $= I + [T(1 + W) - S] - A_1$
Total Usage $= I + [T(1 + W) - S] + A_2$

where I = intercept; T = incremental change in energy for changes in temperature with no wind; W = percent increase in T with wind speed; S = solar input; A_1 = portion of appliance energy that contributes to heating; and A_2 = portion of appliance energy that does not contribute to heating.

Heating Usage, House A = $-10 + [3.3(70 - T')(1 + 0.008W')]$
Total Usage, House A = $-10 + [3.3(70 - T')(1 + 0.008W')] + A'$
Heating Usage, House B = $14 + [3.1(65 - T')(1 + 0.010W')] - 0.77A'$
Total Usage, House B = $14 + [3.1(65 - T')(1 + 0.010W')] + 0.23A'$
Heating Usage, House C = $-24 + [1.9(65 - T')(1 + 0.015W') - 1S']$
Total Usage, House C = $-18 + [1.9(65 - T')(1 + 0.014W') - 1S']$
Heating Usage, House D = $13 + [0.7(65 - T')(1) - 0.3S']$
Total Usage, House D = $26 + [1.3(65 - T')(1 + 0.019W') - 0.6S']$

where A' = kwhr used for appliances and lighting during the day; S' = hours of sunshine during the day; T' = average temperature for the day, deg F; and W' = average daily wind speed, mph.

TABLE II—Average Wind Conditions for Test Houses

House	Average Wind, mph	Coefficient for Average Wind, kwhr/deg F
A	10.9	3.6
B	10.2	3.4
C	10.4	2.2
D	11.2	1.6

TABLE III—Correlation Shows Effect of Temperature

House	Usage	Simple Correlation (temperature only)	Multiple Correlation (all factors)
A	Heating	.881	.889
A	Total	.864	.912
B	Heating	.923	.942
B	Total	.934	.941
C	Heating	.912	.934
C	Total	.922	.944
D	Heating	.733	.767
D	Total	.824	.857

TABLE IV—Calculated Heat Loss

House	Calculated Heat Loss, kw		Energy Demand at Design Conditions	
	NEMA	Tables*	Heating Only	Total House
A	13.9	10.6	10.4	11.8
B	10.8	10.3	9.8	10.4
C	8.6	7.2	5.0	5.3
D	6.7	8.6	5.0 (est)	5.5

*Simplified Tables for Hartford (see page 108 of this issue)

ENGINEERING
REFERENCE
SHEET 57-25

J. B. C. THOMAS, Residential Sales Engineer,
Hartford Electric Light Co, Hartford, Conn.

How to Compute a Room's Heating Needs in 3 Minutes

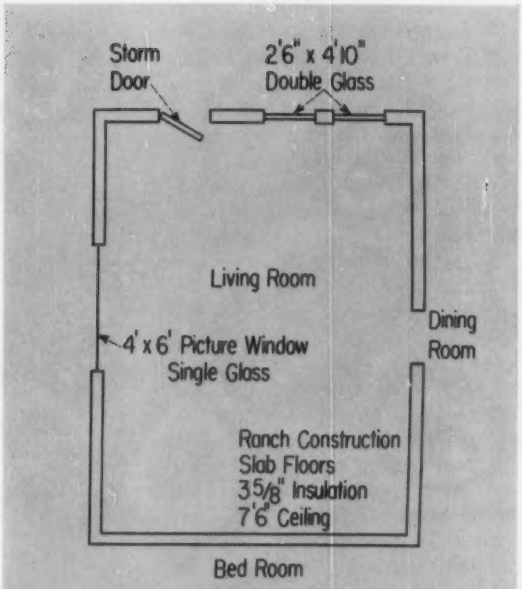
With these tables you can compute electric heating requirements quickly and accurately. Field tests have proved them reliable. Work the example; see how easy they are to use

By using the tables on these pages, an electrical contractor can quickly and accurately compute the electric heating requirements of a house or office. He need only measure the room accurately, apply the tables, and add the resulting figures correctly. This procedure will give him results that have been proved accurate in field tests (pg 104).

Known as the Simplified Tables, these were developed by Mitchel Landau, who holds the copyright, in conjunction with Hartford Electric Light Co for specific use by electricians. The tables apply only to the Greater Hartford Area, where the design temperature range is 0 to 70F. Applying these figures to other temperature zones could result in substantial errors.

In these tables, the more complex factors of the American Society of Heating and Air Conditioning Engineers Guide are converted into watts; all multiplication for room areas performed; corrections made for net wall area; and infiltration by the crack-loss method allowed for.

The accompanying example illustrates correct use of the tables.



Electric Comfort Heating
Simplified Engineering Work Sheet

Customer's Name JOHN DOE
Address 344 NORTH STR.
Contractor's Name TOM SMITH

Room
Type LIVING ROOM
Size 15' x 20'
Ceiling Height 7'6"

Insulation PICTURE-SINGLE
Windows - DOUBLE
Doors STORM
Walls 3 5/8"
Ceilings 3 5/8"
Floors NONE (SLAB)

Table		Measurements	Watts
1.	Outside Walls	35 *Running Feet*	320
	Cold Partitions	*Running Feet*	
2.	Windows	2 2'6"x4'10" *No. Width & Length*	505
		No. Width & Length	
		No. Width & Length	
3.	Picture Windows	1 4' x 6' *No. Width & Length*	600
4.	Outside Doors	1 *Number*	540
5.	Cold Ceiling	15' x 20' *Width & Length*	430
	Cold Floor or	*Width & Length*	
6.	Cold Slab Floor	35 *Running Feet*	365
		Total Watts	2760

Note: For bathroom add 20%

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TABLE 1
OUTSIDE WALL
COLD PARTITION
3⅝" Insulation

Feet Outside Wall	Ceiling Height 7′	7½′	8′	8½′	9′
6	50	55	60	65	65
7	60	65	70	75	75
8	70	75	80	85	90
9	80	85	90	95	100
10	85	90	100	105	110
11	95	100	110	115	120
12	105	110	120	125	135
13	110	120	130	135	145
14	120	130	140	145	155
15	130	140	150	155	165
16	140	145	160	165	175
17	145	155	165	180	190
18	155	165	175	190	200
19	165	175	185	200	210
20	170	185	195	210	220
21	180	195	205	220	230
22	190	200	215	230	245
23	200	210	225	240	255
24	205	220	235	250	265
25	215	230	245	260	275
26	225	240	255	270	285
27	230	250	265	280	300
28	240	260	275	295	310
29	250	265	285	305	320
30	260	275	295	315	330
31	275	285	305	325	345
32	275	295	315	335	355
33	285	305	325	345	365
34	290	315	335	355	375
35	300	320	345	365	385
36	310	330	355	375	400
37	320	340	365	385	410
38	325	350	375	395	420
39	335	360	385	410	430
40	345	370	395	420	440

2" Insulation: Multiply by 1½
1" Insulation: Multiply by 2
No Insulation: Multiply by 4

TABLE 2
WINDOWS
(Casement or Double Hung)
Tight Storm Windows

Size	No. of Windows 1	2	3	4
1′6″x3′2″	135	270	405	540
1′6″x3′6″	145	290	435	580
1′6″x3′10″	155	310	465	620
1′6″x4′2″	165	330	495	660
1′6″x4′6″	175	350	525	700
2′0″x3′2″	160	320	485	645
2′0″x3′6″	175	345	520	690
2′0″x3′10″	185	370	555	740
2′0″x4′2″	195	390	590	785
2′0″x4′6″	205	415	620	830
2′0″x4′10″	220	435	655	870
2′0″x5′2″	230	460	685	915
2′6″x3′2″	185	375	560	785
2′6″x3′6″	200	400	600	800
2′6″x3′10″	215	425	640	850
2′6″x4′2″	225	450	680	905
2′6″x4′6″	240	480	715	955
2′6″x4′10″	250	505	755	1010
2′6″x5′2″	265	530	795	1060
2′6″x5′6″	280	555	835	1110
3′0″x3′2″	215	430	640	855
3′0″x3′6″	230	455	685	910
3′0″x3′10″	240	485	725	970
3′0″x4′2″	255	510	770	1025
3′0″x4′6″	270	540	810	1080
3′0″x4′10″	285	570	850	1135
3′0″x5′2″	300	595	895	1190
3′0″x5′6″	310	625	935	1250
3′6″x3′2″	240	480	720	960
3′6″x3′10″	270	540	815	1085
3′6″x4′2″	285	570	860	1145
3′6″x4′6″	300	605	905	1210
3′6″x4′10″	315	635	950	1270
3′6″x5′2″	330	665	995	1330
3′6″x5′6″	350	695	1045	1390

Without Storm Windows: Multiply by 2

TABLE 3
PICTURE WINDOWS
Double Glass

Width	Height 3′6″	4′0″	4′6″	5′0″	5′6″	6′0″
4′0″	190	210	235	255	275	300
4′6″	210	235	255	280	305	325
5′0″	230	255	280	305	330	355
5′6″	250	275	305	330	360	385
6′0″	270	300	325	355	385	415
6′6″	290	320	350	380	415	445
7′0″	305	340	373	405	440	475
7′6″	325	360	395	430	465	305
8′0″	345	385	420	455	495	530

Single Glass: Multiply by 2

TABLE 4
OUTSIDE DOORS

	With Storm Door	Without Storm Door
For Each Door	540	1080

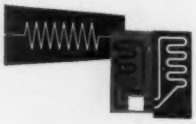
TABLE 5
COLD CEILING—COLD FLOOR
3⅝" Insulation

Length of Room	Width of Room 6′	7′	8′	9′	10′	11′	12′	13′	14′	15′	16′
6′	50	60	70	80	85	95	105	110	120	130	140
7′	60	70	80	90	100	110	120	130	140	150	160
8′	70	80	90	105	115	125	140	150	160	175	185
9′	80	90	105	115	130	145	155	170	180	195	205
10′	85	100	115	130	145	160	175	185	200	215	230
11′	95	110	125	145	160	175	190	205	220	240	255
12′	105	120	140	155	175	190	205	225	240	260	275
13′	110	130	150	170	185	205	225	245	260	280	300
14′	120	140	160	180	200	220	240	260	280	300	325
15′	130	150	175	195	215	240	260	280	300	325	345
16′	140	160	185	205	230	255	275	300	325	345	370
17′	145	170	195	220	245	270	295	320	345	365	390
18′	155	180	205	235	260	285	310	335	365	390	415
19′	165	190	220	245	275	300	330	355	385	410	440
20′	175	200	230	260	290	315	345	375	405	430	460
21′	180	210	240	270	300	325	365	395	425	455	485
22′	190	220	255	285	315	350	380	410	445	475	505
23′	200	230	265	300	330	365	395	430	465	495	530
24′	210	240	275	310	345	380	415	450	485	520	555
25′	215	250	290	325	360	395	430	470	505	540	575
26′	225	260	300	335	375	410	450	485	525	560	600
27′	235	270	310	350	390	430	465	505	545	585	620
28′	245	280	320	365	405	445	485	525	565	605	645
29′	250	290	335	375	420	460	500	545	585	625	670
30′	260	300	345	390	430	475	520	560	605	650	690

Ceiling with 2" Insulation: Multiply by 1½.
Ceiling with 1" Insulation: Multiply by 3.
Ceiling with no Insulation: Multiply by 7.
Floors with 2" Insulation: Multiply by 1¼.
Floors with 1" Insulation: Multiply by 2.
Floors with no Insulation: Multiply by 3.

TABLE 6
COLD SLAB FLOOR

Feet Outside Edge	Insulated	Uninsulated	Feet Outside Edge	Insulated	Uninsulated	Feet Outside Edge	Insulated	Uninsulated
6	40	65	18	125	190	30	210	315
7	50	75	19	135	200	31	215	325
8	55	85	20	140	210	32	225	335
9	65	95	21	145	220	33	230	345
10	70	105	22	155	230	34	240	355
11	75	115	23	160	240	35	245	365
12	85	125	24	170	250	36	250	380
13	90	135	25	175	260	37	260	390
14	100	145	26	180	275	38	265	400
15	105	155	27	190	285	39	275	410
16	110	170	28	195	295	40	280	420
17	120	180	29	205	305			

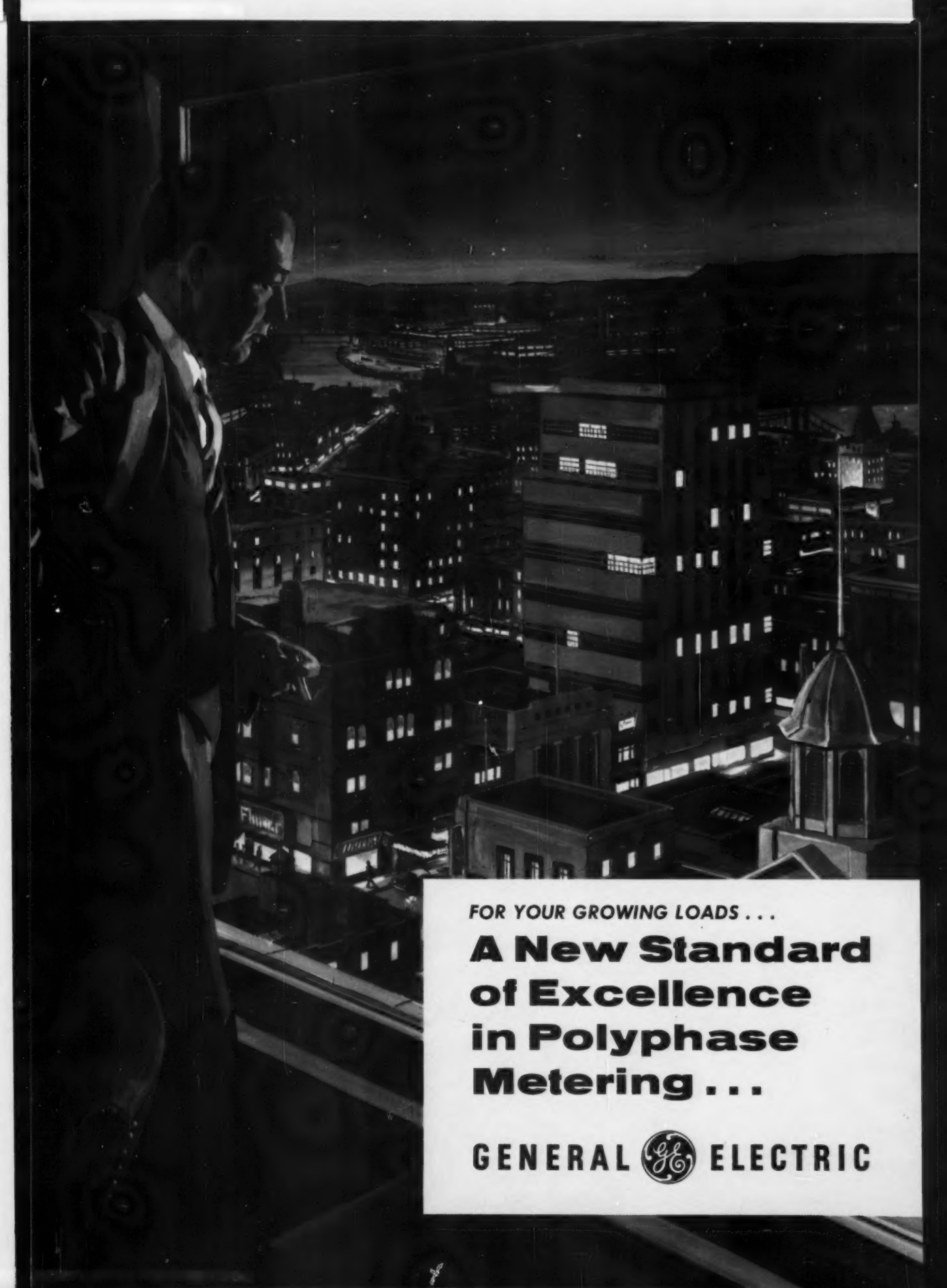


Electric Heating Policy:

How 2 Heat Promoters Determine It

Kansas Gas & Electric Co, and Union Electric Co, two fairly recent promoters of electric heating, have set down what they expect from dealers, contractors, and trade allies in return for their electric heating efforts

	KG&E	Union Electric
EQUIPMENT SIZING & APPLICATION	"We will inform ourselves and our sales allies of the types of electric heating and the best methods of application."	Company sets 'ground rules' which size equipment (heat pumps) to handles temperatures 20 deg. over outside design temperature.
HEAT LOSS CALCULATIONS	"We will equip ourselves to calculate heat losses and estimate operating costs for dealers and electrical heating contractors."	". . . to make heat loss or gain calculations in accordance with acceptable engineering methods, and submit to customer for review."
INSULATION	"We will advise construction sales allies regarding proper construction and insulation to minimize heat losses."	"To require thermal insulation which will limit heat loss to the lowest figure that can be economically justified."
CUSTOMER SERVICE	"We will aid in establishing proper market services in the area we serve."	"To provide competent repair service, to maintain an adequate supply of parts to permit prompt restoration of service."
BILLING	"We will offer budget billing to homes using all-electric heat to level out bills over the year, if the customer desires."	Budget billing is offered on an eleven months basis at a fixed charge. Adjustments are made the twelfth month.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V-60 POLYPHASE METERS

by GENERAL ELECTRIC give you all the advantages of magnetic suspension plus extended range

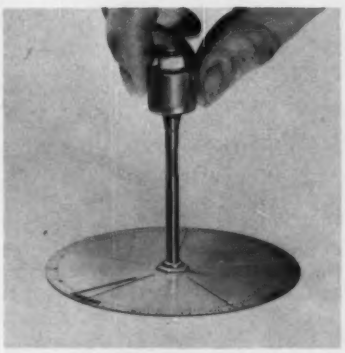
Now for fast-growing polyphase loads everywhere, General Electric's New V-60 Polyphase Meter Family with magnetic suspension gives you greater sustained accuracy, eliminates bearing replacement, helps reduce installation costs and offers you extended current and potential range in just five different meters

YOU GET FLEXIBILITY in metering your various polyphase loads with just five different meters. The new General Electric V-60 family of polyphase meters includes the V-62 network meter, V-63 (3-wire, 3-phase), V-65 (4-wire, Y, 3-phase), V-66 (4-wire, △, 3-phase), and V-68 (totalizing). The extended range—666 2/3% of nameplate rating—means that any of the V-60 family of meters will stay on the job as your polyphase loads climb, whether the loads are residential, commercial, industrial, or special loads such as air conditioning.

YOU GET GREATER SUSTAINED ACCURACY in the new V-60 meters because *magnetic suspension* avoids losses in registration caused by bearing wear. In the V-60 meters, you get the advantages of sustained accuracy which were time-proved in the more than 8 million I-50 series of single-phase meters in service today.

YOU DON'T HAVE TO REPLACE BEARINGS in the V-60 meters because with the *magnetic suspension* system there are no bearings! General Electric *magnetic suspension* cannot wear out . . . even after the equivalent of 300 years on accelerated life tests. With ever increasing polyphase loads, bearings in conventional meters become worn in a few years. With the new V-60 meters, you can lower metering costs by eliminating bearing replacement, due to bearing wobble and inaccurate performance.

YOU CAN SAVE TIME AND MONEY in installing and leveling meters because with the new V-60 family, meter tilt is a negligible factor. Any ordinary meter operating at even a slight tilt will give inaccurate readings and will result in substantial revenue losses. Lab tests prove that G-E meters with *magnetic suspension* practically eliminate revenue losses due to tilt.



For more information on the new V-60 family of polyphase meters, or on any of the complete G-E line of meter products, contact your nearest G-E representative or Apparatus Sales Office, or write General Electric Company, Section 623-1, Schenectady 5, N. Y.

GENERAL ELECTRIC

NOW FROM GENERAL ELECTRIC...

Get Accurate Metering of Heavy Residential Loads with the New V-62 Meter

New General Electric Polyphase Network Meter, first of the new G-E V-60 family of polyphase meters, gives you all the really great advantages of the time-proved I-50 series of single-phase meters.

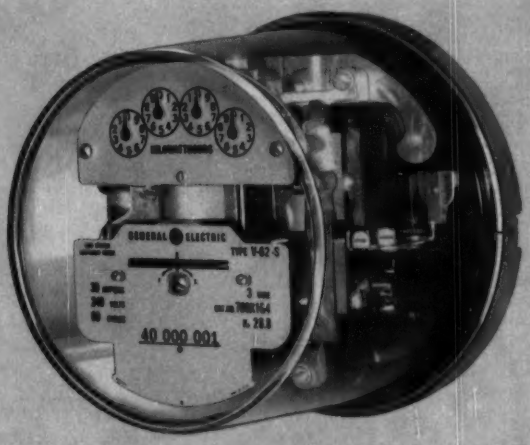
FOR GROWING POLYPHASE LOADS of both today and tomorrow, the all-new V-62 meter with *magnetic suspension* is available in both Class 100 and 200 ratings in either socket or bottom-connected types. In addition, this new network meter can be used in your 3-wire, 3-phase applications.

MAGNETIC SUSPENSION in the V-62 gives you the real advantages of greater sustained accuracy and no bearing replacement. You can lower your installation costs by spending less time and money on troublesome leveling of meters, since meters with *magnetic suspension* are less affected by tilt.

EXTENDED RANGE of the V-62 allows loads up to 666 2/3% of rated current to be metered without the need for current transformers. This means that meter replacement is unnecessary as polyphase network loads grow — whether the loads are residential or commercial.

MAXIMUM SURGE PROTECTION comes from coordination of surge-relief gaps and butyl-molded coil insulation. The revolutionary new gap system in the V-62 provides outstanding surge-current relief and helps avoid lightning damage and costly meter burn-outs.

ADDITIONAL FEATURES of the new V-62 network meter are ease of assembly and disassembly, excellent calibration stability, high corrosion resistance, interchangeability of registers with present meters, outstanding single-stator performance, and improved nameplate visibility.



GET ALL THE DETAILS OF THE NEW V-62 METER BY CONTACTING YOUR G-E REPRESENTATIVE OR APPARATUS SALES OFFICE, OR BY WRITING SECTION 623-1, GENERAL ELECTRIC COMPANY, SCHENECTADY 5, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Store Bushings on Switching Structure

C. P. ZIMMERMAN, Elec. Equipt. Section Head, American Gas & Electric Service Corp, New York, N. Y.

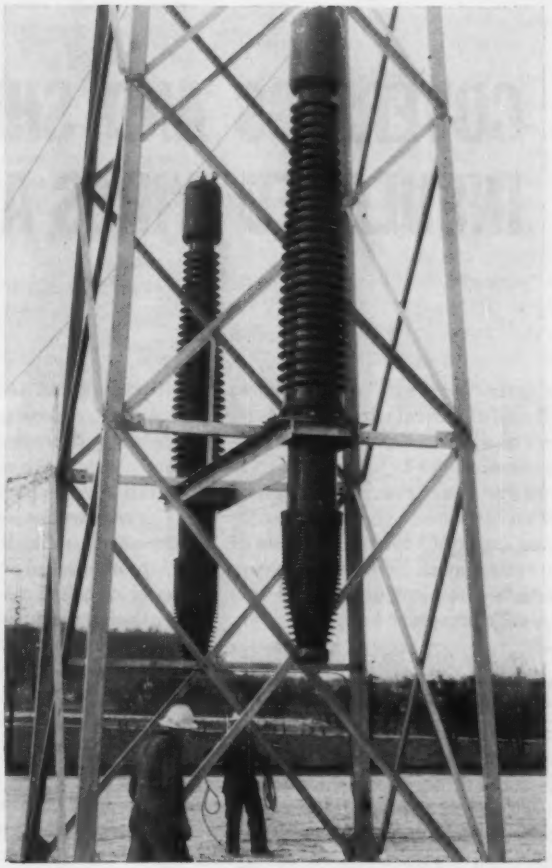
How to store 345-kv bushings for transformers and oil circuit breakers was one of many problems that arose in conjunction with AG&E's development of the 345-kv system. Such bushings cost about $12,000 each and therefore represent a sizeable investment. Considering the amount of installed 345-kv equipment it was felt that a number of these bushings should be available on the system as spares.

Weighing about 3,500 lb apiece and having an overall length of about 21 ft, the bushings present a handling problem. Line trucks are inadequate so that cranes or special handling equipment must be used.

The bushings are of sealed, oil-filled construction. Accordingly, they can be stored outdoors in either a horizontal or vertical position. But storing them upright makes it impossible to subject them to periodic Doble tests of their insulation without moving them. Bushings kept in a horizontal position over an extended period must wait several hours after installation before they can be safely energized. The delay allows air trapped in the core insulation to rise to the top and insures that there is no reduction in insulation strength.

Accompanying illustration shows a simple, low-cost mounting bracket attached to steel columns of a switching structure. Each bracket can hold two bushings, which are merely slipped in between the the two main support angles to which the bushing flanges are bolted and the closing angles added.

Bushings of this size offer considerable wind resistance. The mounting arrangement was designed to withstand the forces of a 90-mph wind.



GENERATION—Operation

Timer Halts Salt Loss in Water Softeners

D. C. BROWN, Chief Chemist, Sporn Plant,
F. E. TITUS, Electrical Maintenance Foreman, Central Operating Co, New Haven, W. Va.

Insertion of a timer in the float-switch circuit has ended what might have been a yearly loss of 20 to 40 tons in Sporn Plant's operation of automatic regenerating water softeners. The loss was due to faulty operation of the brine control.

At the plant, concentrated brine is supplied by two salt-saturator basins. The brine flows through the solenoid-controlled, air-operate valve (I) to the brine-measuring tank. This tank contains a float-switch (63 BMT). From the tank the brine flows through a multi-port, air operated valve (II) controlled by the regeneration cycle onto the top of the water-softener bed.

When the measuring tank is full, its float switch cuts off the brine supply. The amount of brine fed to the softener bed is predetermined for a specific operating capacity. When the regeneration control operates, the multi-port valve (II) between the measuring tank and softener bed is turned automatically to the brine-discharge position. The required amount of brine having

(*Continued on page* 120)

[DATA FROM KW ENGINEERS]

COVERINGS AND SHEATHS FOR INSULATED WIRES AND CABLES

Dr. E. G. Sturdevant
Technical Director
Electrical Conductor Division

The term "coverage," as applied to insulated electrical wires and cables, refers to a relatively continuous homogeneous layer or layers of impervious and inert material, applied over an insulated conductor or conductor assembly for the purpose of protecting such conductors from moisture, chemical attack and mechanical damage.

Coverings may be colored, ridged or embossed to indicate circuit identification. Chemical attack refers to damage to the insulation resulting from acids, alkalies and other chemicals in the atmosphere, the ducts or soil in which the cables may be installed. Mechanical damage may result from the abrading, compressing, cutting and tearing forces to which the insulation may be subjected during installation and service.

Coverings may be made of metallic or non-metallic materials. Metallic coverings may be, (1) a continuous metal tube over the insulated conductor, usually made of lead and known as a lead sheath, (2) metal tapes applied spirally about the insulated conductor and referred to as an armor or a shield, depending on the purpose for which it is used, or, (3) metal wires applied spirally either in one direction or in the form of a braid, and again known as an armor or a shield.

Armor is a covering applied primarily for mechanical protection or to add strength for safety purposes while a shield is applied to protect the insulation from electrical stresses and prevent interference in communication conductors. Nonmetallic coverings may consist of, (1) a continuous layer of vulcanized rubber or rubber-like material, generally neoprene, or a thermo-plastic material, called a jacket, (2) spirally applied, moisture-resistant fibrous yarn, usually cotton, glass yarn, or jute, (3) moisture-resistant fibrous tapes, or, (4) moisture-resistant fibrous braids. Combinations of two or more of these may be used as explained later.

The kind and number of coverings used is determined largely by the size of the conductor or cable, the type of insulation on the conductor and the installation conditions. The following is a brief outline of the types of coverings required for the more important types of insulations and installation conditions.

Installation in Dry Conduits and Ducts

Single-conductor rubber and varnished-cambric insulated cables require a covering over the insulation consisting of a moisture-resistant cotton braid on the small sizes and a double braid or tape and braid on the large sizes for protection against mechanical damage. On 600 volt cables for installation in buildings this covering must be flame-resistant, and is usually colored for circuit identification. A neoprene jacket may replace such fibrous coverings on rubber-insulated cables. Paper-insulated cables require a lead sheath for retention of the impregnant, exclusion of moisture, and for mechanical protection. Single-conductor polyvinyl chloride insulated cables usually require no coverings since they are generally considered resistant to flame, water, chemical and mechanical damage.

Multiple-conductor cables which consist of two or more single conductors assembled as a unit are protected by an outer covering. The individual conductors of multiple-conductor rubber insulated cables are generally protected by a single fibrous covering. The outer covering of multiple-conductor cables usually consists of a tape and moisture-resistant cotton braid on rubber and varnished-cambric insulated cables. A neoprene jacket may replace the outer braid on rubber-insulated cables. A polyvinyl chloride jacket is generally used on, but not restricted to, polyvinyl chloride insulated multiple-conductor cables. Multiple-conductor paper-insulated cables have a lead sheath over the assembled insulated conductors.

Installation in Wet Conduits and Ducts

The coverings described for use in dry locations on both single- and multiple-conductor cables are suitable for use in wet locations, except that a lead sheath is required over

varnished cambric, paper and non-moisture-resistant rubber and polyvinyl chloride insulations. Where possibility of chemical attack on lead sheath cable exists, cable is provided with neoprene or polyvinyl chloride jacket over lead sheath.

Moisture-resistant rubber insulation requires mechanical protection in the form of a fibrous covering or coverings or a neoprene jacket. A neoprene jacket is preferred because of its greater resistance to deterioration in wet locations. Moisture-resistant polyvinyl chloride may be used without a covering on single-conductor cables.

Aerial Installations

The types of coverings described for use in wet locations are generally suitable for aerial installations but greater thicknesses of non-metallic coverings, particularly for single-conductor cables, are required. Fibrous coverings for aerial use are usually made of moisture-resistant jute, sisal or loom-woven cotton of large size. Neoprene jackets on single-conductor cables for aerial installations are greater in thickness than those used for duct installations.

These thicker covers provide the additional mechanical protection required for aerial installations. Neoprene jackets are generally preferred over fibrous or rubber jackets because of their greater resistance to weathering. Lead sheathed cables with the same sheath thickness as used for duct installations are suitable for aerial installations. A lead alloy containing small amounts of antimony or tin is used instead of pure lead to reduce failures due to crystallization.

Direct Burial

For direct-burial installations, rubber, rubber-like or thermoplastic jackets or lead sheaths are generally used. The jacket or sheath thicknesses are the same as those used for aerial installations. Lead sheaths require protection against mechanical damage. This usually consists of two servings of moisture-resistant jute yarn immediately over the lead, followed by two steel tapes over which are applied two servings of moisture-resistant jute.

Submarine and Vertical Cables

Submarine cables require protection against mechanical damage and need additional strength over that provided by the conductors to prevent them from being broken by dragging anchors or other objects. Vertical cables frequently require greater strength for their support than that provided by the conductors. This additional strength and mechanical protection is usually provided by a serving of steel wires which completely covers the surface of the cable. This is known as a wire armor. A bedding consisting of two moisture-resistant jute servings is provided between the non-metallic jacket or lead sheath and the armor wires.

Portable Installations

Cables for portable installations such as those used on dredges, shovels and mining equipment must be flexible and their sheaths must be resistant to abrasion, cutting and tearing. Tough wear- and weather-resistant rubber or rubber-like jackets are therefore used. Such jackets are generally made in two layers with a reinforcing braid of high-strength cotton, rayon or glass yarn between them. The jacket thicknesses for such cables are generally greater for a given size of cable than those of cables for non-portable installations.

Shielding

Shields consist of one or more conducting layers on insulated electric power cable the purpose of which is to confine the dielectric field to the insulation on the individual conductors. The three most important functions of shields are, (1) to protect the insulation against harmful electrical stresses and discharges at its surfaces, (2) prevent induced voltage in a conductor from outside sources, and (3) to reduce hazards of shock.

Harmful electrical stresses can occur at both the internal and external surfaces of an insulation, particularly on stranded conductors. At high voltages, it is necessary to provide shields at both surfaces. Internal shielding in the form of a semi-conducting fibrous material is generally used immediately over the conductor for operating voltages above 2000. External shielding usually consists of a semi-conducting fibrous layer immediately over the insulation over which is applied a layer of metallic material. External shields are generally used at voltages above 3000 for non-metallic jacket cables and above 10,000 for lead-sheathed cables.

Metallic shields are made of non-magnetic materials such as aluminum or copper and are applied as tapes on cables for non-portable installations and as braids for portable cables. External shields must be grounded at all joints and terminals.

A KW representative or a KW distributor will be glad to give you immediate attention. Call your Kaiser Aluminum sales office. Kaiser Aluminum & Chemical Sales, Inc., *Executive Office*, Kaiser Bldg., Oakland 12, Calif.; *General Sales Office*, Palmolive Bldg., Chicago 11, Ill.

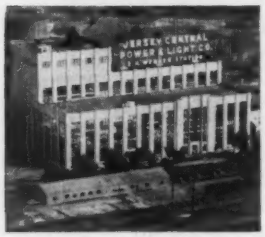
KAISER Aluminum

THE BRIGHT STAR OF METALS

SEE "MAVERICK" • SUNDAY EVENINGS, ABC-TV NETWORK • CONSULT YOUR LOCAL TV LISTING

J.C.P.&L.'s New Sayreville Addition to have HAGAN INSTRUMENTS AND CONTROLS

Jersey Central Power & Light Company is well acquainted with Hagan controls. Their E. H. Werner Station, South Amboy, New Jersey addition is equipped with Hagan Automatic Combustion Control, 3-Element Feedwater Control, and Hagan Ring Balance meters. Base-loaded, their 62,500 kw addition has been on automatic control since it began operation in 1953. Hagan was again selected for the new boiler addition at the Sayreville Station, Sayreville, New Jersey.



Jersey Central Power & Light's E. H. Werner Station. The most recent unit, shown at the left, is fired by two Cyclone furnaces, the first to be installed in the Eastern United States.

At Sayreville, Hagan equipment will include Combustion Control, 3-Element Feedwater Control, Feedwater Pump Recirculation Control, Principal Metering and Panels. In general, the systems will follow the pattern established at the E. H. Werner Station since the boilers at both stations are fired by Cyclone furnaces, two at Werner and four at Sayreville. The Sayreville boiler will operate to produce 900,000 lbs of steam per hour at 2050 psig and 1050 F with reheat at 1000 F.

Both management and operating personnel are satisfied with the reliability, accuracy and low maintenance costs made possible by Hagan control systems. Why not take advantage of the problem-solving skills developed by more than 35 years of experience with boilers of all types? A Hagan engineer will be happy to work with you on the design of controls for new plants or plant expansions. Write or phone:

HAGAN CHEMICALS & CONTROLS, INC.

HAGAN BUILDING, PITTSBURGH 30, PENNSYLVANIA
DIVISIONS: CALGON COMPANY, HALL LABORATORIES
IN CANADA: HAGAN CORPORATION (CANADA) LIMITED
OFFICES IN: MONTREAL, TORONTO, VANCOUVER, EDMONTON

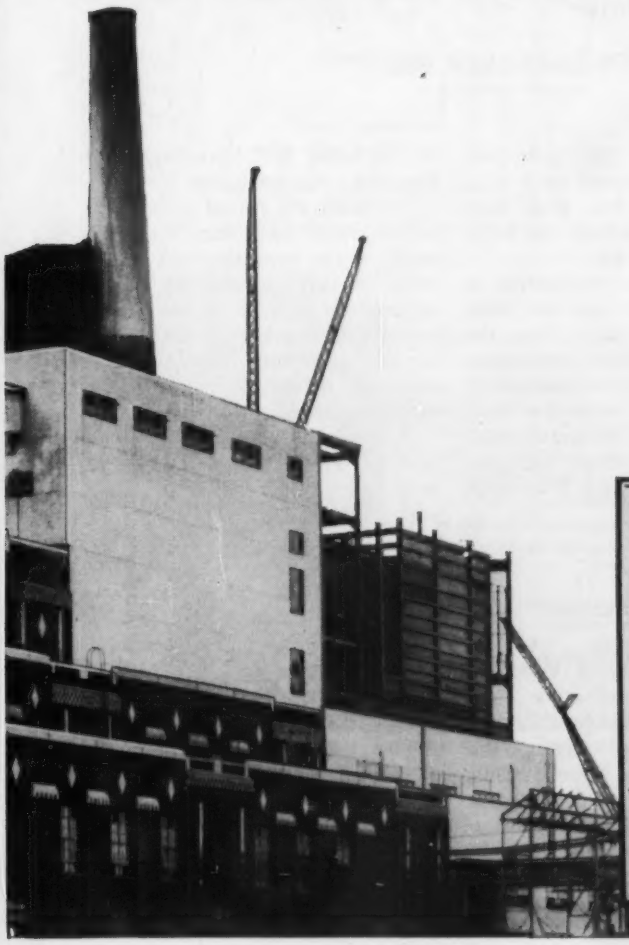
THREE-ELEMENT FEEDWATER CONTROL SYSTEM

Steam Flow Transmitter. The signal from this instrument is combined in a Hagan Ratio Totalizer with the signal from the Feedwater flow meter to hold these two variables in proper relationship during load changes. The inherent accuracy of the Hagan Ring Balance together with the unique spring resistance system permits easy range change, and more precise measurement of low flows.

Feedwater Transmitter. Feedwater flow is held in relation to Steam Flow, with final correction supplied by Drum Level. The combined signal is used to control feedwater pump speed. Jersey Central personnel like the ease with which the Hagan Ring Balance can be checked for calibration utilizing a dead weight system. The check is quick and can be made under full static pressure.

Drum Level Transmitter. The drum level instrument is automatically compensated for water density by a simple integral linkage which requires no external power source. The compensation insures a true measurement of this important variable. The signal from this instrument is transmitted to another Hagan Ratio Totalizer to provide control of level on a compensated basis.

Console and panel at the E. H. Werner Station. Centralized control conserves manpower and provides operator with a complete picture of station operation. The Ring Balance Instruments on the panel are recording all principal flows, pressures and levels.



GROWING BIGGER FOR GROWING NORTH JERSEY
THIRD *New Power* ADDITION -- 137,500 KW.

SAYREVILLE STATION
JERSEY CENTRAL POWER & LIGHT CO.

TOTAL CAPACITY OF SAYREVILLE STATION
WITH NEW ADDITION -- 375,000 KW.

BURNS AND ROE INC. ENGINEERS AND CONSTRUCTORS
NEW YORK, N.Y. · HEMPSTEAD, N.Y. · WASHINGTON, D.C.
DETROIT, MICH. · BALTIMORE, MD.

clear
lines
fast with...

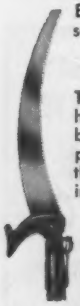
SEYMOUR SMITH
"Telephone" Tree Pruner

Here's the standard, the choice of the utility industry for years. Powerful action to cut cleanly—tough and almost unbreakable—easy to handle. No. 12 Pruner Head has 1½" cutting capacity. The lighter, No. 11, handles up to 1" branches. Both are malleable iron castings with tempered steel cutting blade.

Poles (18 ft. 3 sections) are of selected spruce with positive locking, seamless aluminum, telescoping ferrule joints.

FAST CUTTING PRUNING SAWS

Designed for fast, easy cutting—large, deep teeth, finest Swedish charcoal steel, streamlined, laminated hardwood handles. Every model you need up to chain saw work.



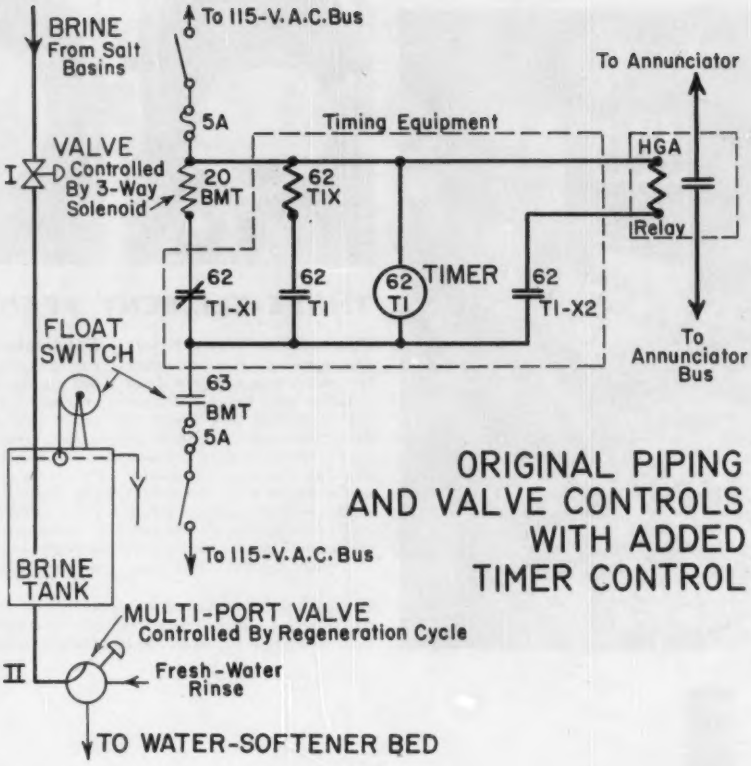
No. 20 POLE SAW HEAD

Tough aluminum head with large hook and outside horn for pushing branches, raising wires, etc. Also paint brush holder with wire clamp that holds brush securely. Fast-cutting 16" blade. Poles available.

FREE: Send for Seymour Smith catalog pages on tools for utilities. Keep them on file for easy reference.

Quality Tools
SEYMOUR SMITH
Since 1850

SEYMOUR SMITH & SON, Inc.
2412 Main St., Oakville, Conn.



ORIGINAL PIPING AND VALVE CONTROLS WITH ADDED TIMER CONTROL

been discharged, the multi-port valve is turned automatically to a rinsing position. The time float switch (63 BMT) admits the brine to the measuring tank.

Several times the changeover to rinse did not occur, and the brine continued to discharge from the measuring tank which was automatically filling. As a result, brine from the saturator basins continued to flow through the measuring tank and thence to the softener bed until the faulty operation was noticed or all the brine had been discharged from the saturator basins.

The timer was placed in the float-switch circuit controlling the brine supply to the measuring tank. Now, when the tank's normal level is not restored in 6 min, the timer operates an annunciator which notifies the operator of trouble and also shuts off the brine supply to the measuring tank.

A loss of 20 tons of salt would cost $280. Cost of the timer installation was less than $70.

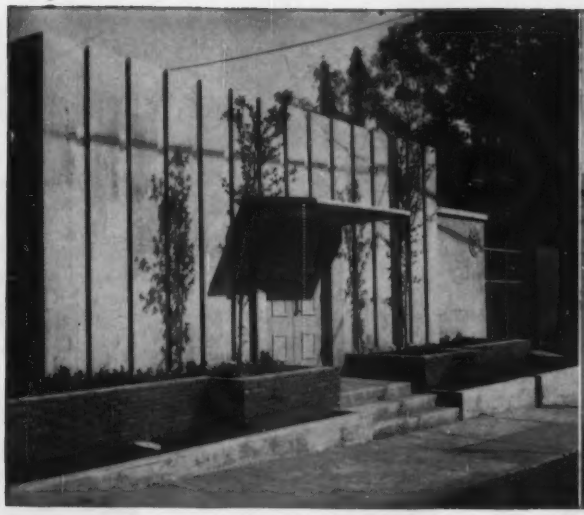
DISTRIBUTION—Construction

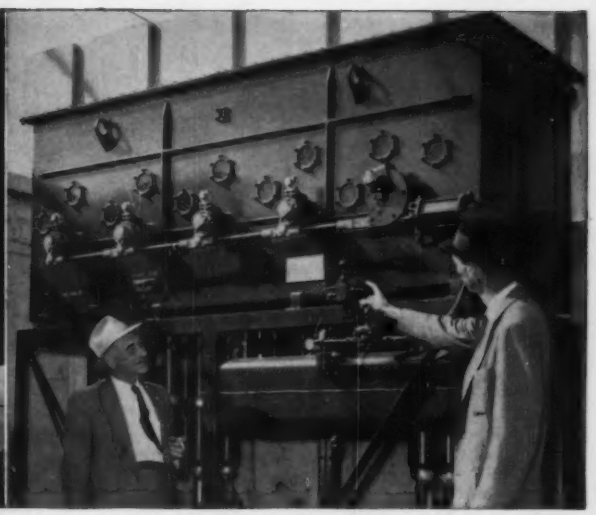
Underground Truck Works Narrow Alleys

Public Service Co of Colorado has an "outside-in" underground trouble truck. Side compartments are accessible from within the truck body, easing withdrawal of materials, tools and equipment when the truck is working in narrow alleys.

The van-type body is on a dual rear-wheel parcel delivery truck chassis, designed by Public Service engineers and built locally.

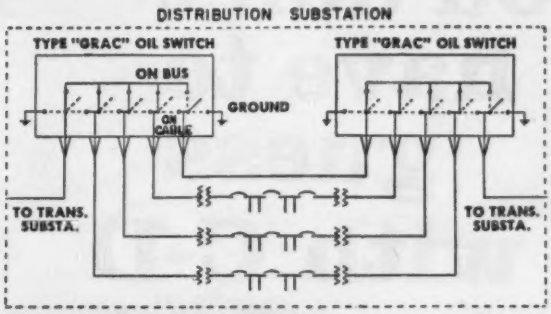
Refinements include a rear pipe extension for supporting a canvas canopy over the manhole, a small rear-mounted derrick to overhang the hole, and a 15-kw, 110-v generator driven by power take-off from the truck engine.

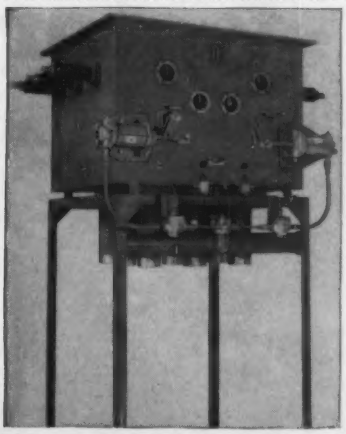




LOAD BREAK SWITCHING F-L-E-X-I-B-I-L-I-T-Y FOR 34.5 Kv. CIRCUITS

A large municipal utility installs a complete substation on a small city lot. Reduces maintenance to a minimum by eliminating all exposed buses, disconnects, etc. by using G & W Type "GRAC" oil switches.





Type "TGRAL" oil switch 3 way, 2 sets of links, 34.5 Kv. 400 ampere, full load break—with two pneumatic operating mechanisms. This and other styles of Type "RA" load break oil switches are available to provide safe sectionalizing at all voltages up to 34.5 Kv.

The G & W Type "GRAC" oil switches are 5 way, 34,500 volts, 400 amperes, with buses and 5 sets of switching links. The outer "ways" of each switch are for the feeder and feeder-tie cables and the three center "ways" are for cables to the load transformers.

A pneumatic mechanism, with manual control, provides for full 400 ampere load break at 34.5 Kv. Switching, therefore, can be done at the distribution substation without opening the circuit breakers at the transmission substations, which are located up to five miles away.

The oil switches and the feeder-tie cables facilitate energizing both ends of the double ended unit transformer stations from only one of the transmission substations during emergency conditions.

Ground positions for the two outer "ways" of each oil switch permit grounding the feeder and the feeder-tie cables. The center tap cables can be grounded also, by switching to the "ON CABLE" positions.

The one pneumatic mechanism on each switch is used for operating any of the five sets of links, by inserting a pin in the proper lever.

All switch cableheads are for single conductor gas filled cable stubs which are spliced to three conductor gas filled cables.

Send for series "D" bulletins. Get in touch with our nearest representative.

G&W ELECTRIC SPECIALTY COMPANY
3500 W. 127th ST., BLUE ISLAND, ILLINOIS

D573

Representatives in many cities of U. S. A., N. & S. America — Canadian Mfr. — Powerlite Devices, Ltd., Toronto, Montreal & Vancouver

High Voltage Cable Terminating, Sectionalizing, Protecting, and Connecting Devices

POTHEADS • BOXES • OIL FUSE CUTOUTS • LOAD BREAK OIL SWITCHES • SPLICING KITS

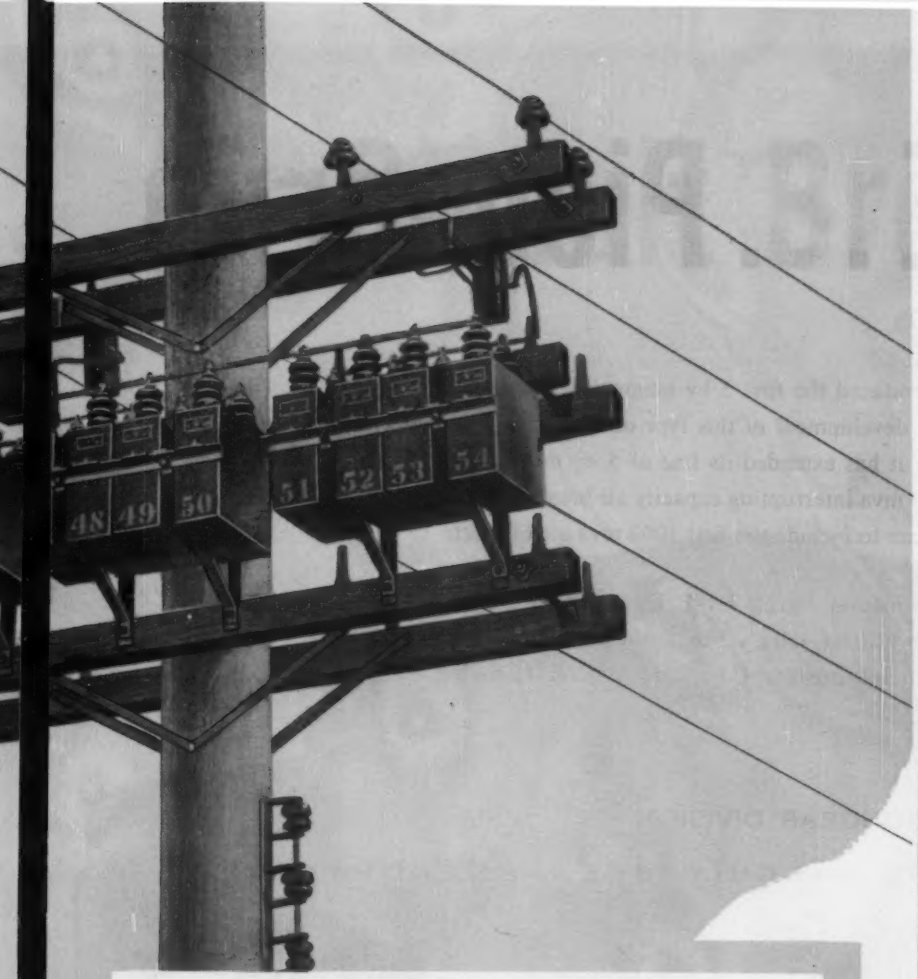
WITH C-D CAPACITORS THERE'S NO GUESSING. The field performance records speak for themselves. Capacitors installed over 20 years ago, are still operating trouble-free — 24 hours a day.

The reasons? Because of C-D's basic and thorough understanding of capacitor utilization problems . . . design research that anticipates emergency needs . . . scrupulous inspection . . . rugged construction . . . conservative ratings.

Invest your purchasing dollar in internal quality — the only place where it counts.

Insure low-maintenance service from your next power-factor capacitor installation, by talking it over first with a C-D engineer. Just write Cornell-Dubilier Electric Corporation, Dept. D-77 South Plainfield, New Jersey.

You don't have to guess with C-D power-factor capacitors...



Here's why C-D Capacitors consistently exceed all field performance requirements:

• Lowest dielectric unit stress and highest major insulation level. • Dykanol-filled bushings increase accepted flashover safety-factor, insure high level of impulse withstand. • Removable solderless connectors. • Many sections in series-parallel connection. Extremely low voltage gradient per section; less heating; no corona; longer life; lower power-factor. • Discharge resistor connected to each series section, instead of terminal to terminal. Provides effective discharge for each series group and balanced voltage distribution. • Side mounted lifting lugs—stronger and avoid risk of flashover. • Energization tested, 100 percent, to assure uniform distribution of low dielectric losses.

CORNELL-DUBILIER

consistently dependable

power-factor capacitors

SOUTH PLAINFIELD, N. J.; NEW BEDFORD, WORCESTER & CAMBRIDGE, MASS.; PROVIDENCE & HOPE VALLEY, R. I.; INDIANAPOLIS, IND.; SANFORD, FUQUAY SPRINGS & VARINA, N. C.; VENICE, CALIF.; & SUB.: THE RADIART CORP., CLEVELAND, OHIO; CORNELL-DUBILIER ELECTRIC INTERNATIONAL, N. Y.

BOOKS

How to Use Transistors

Transistor Circuit Engineering. Edited by R. F. Shea. Published by John Wiley & Sons, Inc, 440 Fourth Ave, New York, 16, N. Y. 468 pages, illustrated. Price $12.00.

Application of transistors for practical electronic circuits is the basis of this text. The book is written by staff members of the General Electric Electronic Laboratory. In addition to the material on transistor circuit engineering, it contains enough material on basic transistor theory to make it a self-sufficient book for the engineer interested in this field.

Use of transistors in amplifier, oscillator, modulator, mixer, and modulator circuits is discussed. And information on use of these circuits in radio, carrier current, and television systems rounds out the text of the book.

Magnetic Amplifiers Explained

Magnetic-Amplifier Circuits, 2nd edition. By W. A. Geyger. Published by McGraw-Hill Book Co, 330 W 42nd St, New York 36, N. Y. 394 pages, illustrated. Price $7.00.

This book is primarily for the circuit designers. But it gives enough material on fundamental principles and characteristics to qualify it as a complete study of magnetic amplifiers. In this edition, the treatment has been enlarged to cover advances in the field —stable high-speed magnetic amplifiers and application of magnetic amplifiers in high performance closed loop servo systems—and to expand material on transient response.

Descriptive and graphical, rather than mathematical, method of presentation is used. Elaborate reference material is presented including a list of European and American patents and associated technical papers.

Books Received Since September 11, 1957

Synthesis of Passive Networks. By Ernst A. Guillemin. Published by John Wiley & Sons, Inc, 440 Fourth Ave, New York 16, N. Y. 731 pages, illustrated. Price $15.00.

Electricity and Electronics-Basic. By William B. Steinberg and Walter B. Ford. Published by American Technical Society, 848 East 58th Street, Chicago 37, Illinois. 235 pages, illustrated. Price $4.50.

Analytical Design of Linear Feedback Controls. By George C. Newton, Jr., Leonard A. Gould, and James F. Kaiser. Published by John Wiley & Sons, Inc, 440 Fourth Ave, New York 16, N. Y. 409 pages, illustrated.

U. S. Research Reactors. Prepared by Battelle Memorial Institute. Released by United States Atomic Energy Commission, Washington 25, D. C. 73 pages, illustrated. Price $1.50.

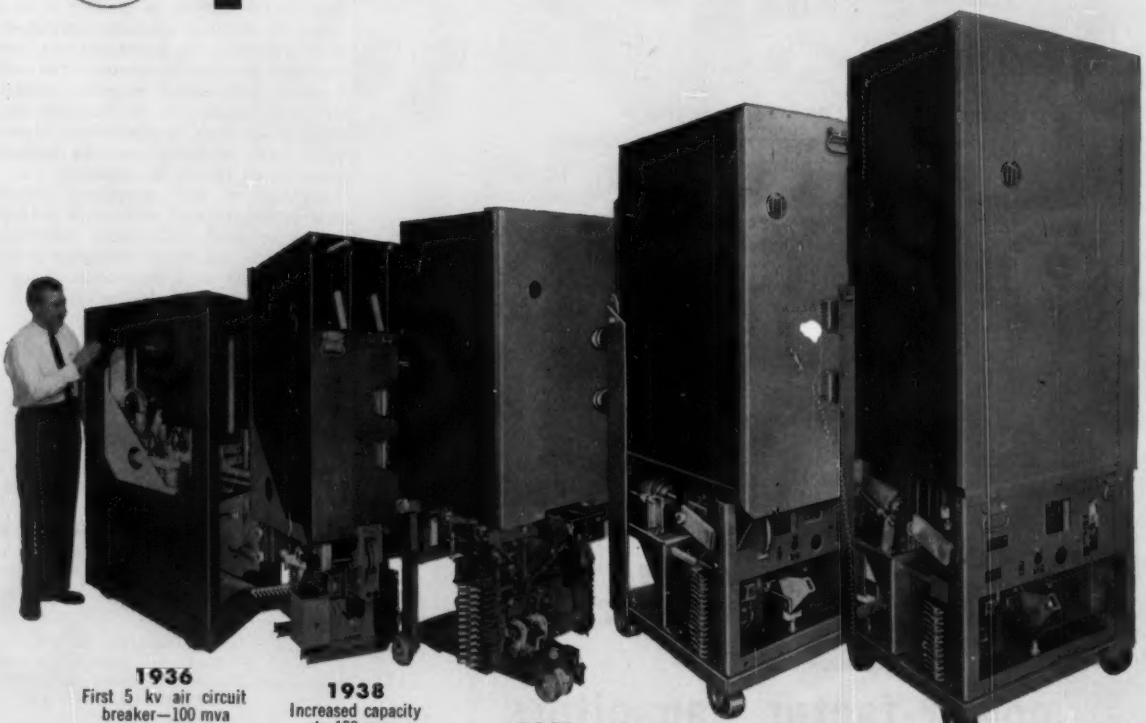
I-T-E...Pioneer in

In 1936, I-T-E introduced the first 5 kv magnetic air circuit breaker and it has led the field in development of this type of equipment ever since. In the past 4 years alone, it has extended its line of 5 kv metal-clad switchgear to include the first 350 mva interrupting capacity air breaker and its line of 15 kv metal-clad switchgear to include the first 1000 mva air breaker.

Get complete information on all I-T-E high voltage magnetic air circuit breakers. Call our nearest sales office today for it. Or write Switchgear Division, I-T-E Circuit Breaker Company, 19th & Hamilton Sts., Philadelphia 30, Pa.

SWITCHGEAR DIVISION

I-T-E CIRCUIT BREAKER COMPANY



1936
First 5 kv air circuit breaker—100 mva

1938
Increased capacity to 150 mva

1950
Reached 250 mva rating

1954
Brought out 15 kv air circuit breaker

1956
350 mva in 5 kv class

Air Circuit Breakers

1956
750 mva in 15 kv class

1957
Now the 1000 mva
15 kv circuit breaker

Luxury Motel Hosts Its Guests All-Electrically

M. I. STALHEIM, Commercial Sales Coordinator, Carolina Power & Light Co, Florence, S. C.

The utility likes it, the guests like it, the host likes it.

That, in brief, is the happy story of all-electric heating and air conditioning in a 62-unit luxury motel on U. S. 301 near Dillon, S. C.

For the Carolina Power & Light, selling South of the Border Motel some 798,680 kwhr a year means a revenue of $9,983—equal to Revenue from a small industry.

For owner Al Schafer, all-electric service has added up to low maintenance, cleanliness, and satisfied customers—at an average cost of 1¼¢ per kwhr. That's why the 38 new units now under construction will be all-electric also.

The present 62 guest rooms, office, and special rooms have a connected load of about 594 kw. Maximum demand so far has been 278 kw, reached during February. The new addition will have a connected load of about 325 kw, and a demand of 125 kw, bringing the total demand to about 400 kw.

Each unit has one 4-kw recessed wall heater in the bedroom and a 1,500-watt heater in the bathroom. A ¾-ton reverse-cycle window unit provides air conditioning in the summer and heating in early spring and late fall. Thermostats control all units.

Total Corrected Load: 594 Kw

Total connected load: resistance heat units, 353 kw; water heating, 78 kw; air conditioning, 70 kw (62 room units plus 9½ tons in the office); lighting, 53 kw; ice maker, 3 kw. In addition, there are 64 TV sets and 13 hp in water and swimming pool pump motors. Service for this total 594 kw is taken at 120/208v 3-phase through one point of delivery and one meter.

The section under construction will be metered separately because of the 400 ft between points of delivery. The load will be 4.5 kw per room for heating, instead of 5.5 kw, and the reverse-cycle window units will be one-ton instead of ¾.

In these 62 units, area of heated space totals 21,400 sq ft; volume, 175,000 cu ft. The individual room measures about 12 ft by 17 ft 4 in.

The 36-sq ft office-lounge has double panel glass walls front and back, 18 ft of glass wall on each side, and three glass entrance doors.

Total heat loss is 803,630 Btu—12,000 Btu for each room unit and 39,630 for the office lounge.

Because the customer receives his total electric service through one meter, heating consumption and cost must be estimated. (See table). This estimate is based on 9 mills per kwhr for the maximum energy cost, plus $1.20 per kw demand, less 3% for term discount. This gives an average of 1.23¢ per kwhr.

Here's how heating costs were determined:

$$\text{Est. kwhr for heating} = \frac{HL/3{,}412) \times DD \times C}{TD}$$

Where

HL = heat loss in Btu

DD = degree days for season

TD = difference in inside and outside design temp.

C = constant, 16, found to be accurate for installation of this type in Dillon area

Annual consumption for heating = 144,600 kwhr

Annual cost for heating @ 1.1¢ per kwhr = $1,590.60

Annual cost for heating each room and pro-rata part of office = $25.66

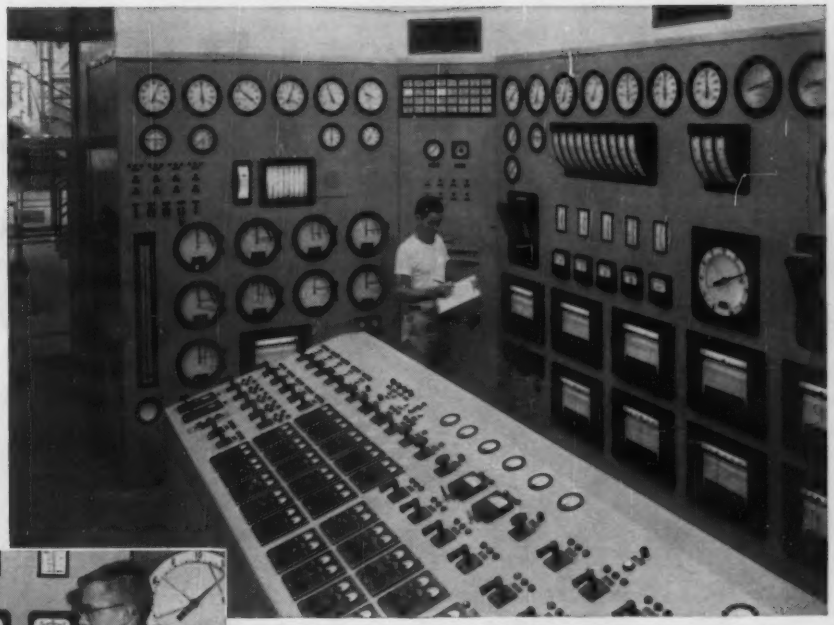
The South of the Border story points to a healthy electric heating market. We at CP&L are using it to capitalize on selling electric heating to motels and commercial buildings.

(*More Selling on page* 130)

Billing Data and Estimated Heating Cost for Motel

Months	Total kwhrs	Actual Metered Demand (kw)	Total Cost
Oct 1956	43,400	154kw	$610.47
Nov	49,680	163	664.60
Dec	78,960	216	941.38
Jan 1957	92,160	269	1,118.44
Feb	78,720	278	1,015.60
March	91,920	252	1,101.55
April	55,920	262	798.87

Controls for the turbine section of the plant are mounted on this side of the control room.



Honeywell field engineer, left, services an *ElectroniK* strip chart recorder at Alabama Power Company's Gorgas plant, as an Alabama Power engineer looks on.

Alabama Power Company Relies on Honeywell Instrumentation and Service

Alabama Power Company gains major advantages through use of Honeywell instrumentation at its Gorgas Steam Plant near Birmingham. One of these is dependable, accurate control over both boiler and turbine sections. The Gorgas plant is Alabama Power's first installation to combine instrumentation for both sections in a central control room.

Equally important is unmatched Honeywell service. Here, as in other installations, field engineers from the local Honeywell branch office provided service assistance at startup. And, should emergencies develop, service from Honeywell usually arrives in less than 24 hours after a call . . . anywhere in the U.S.

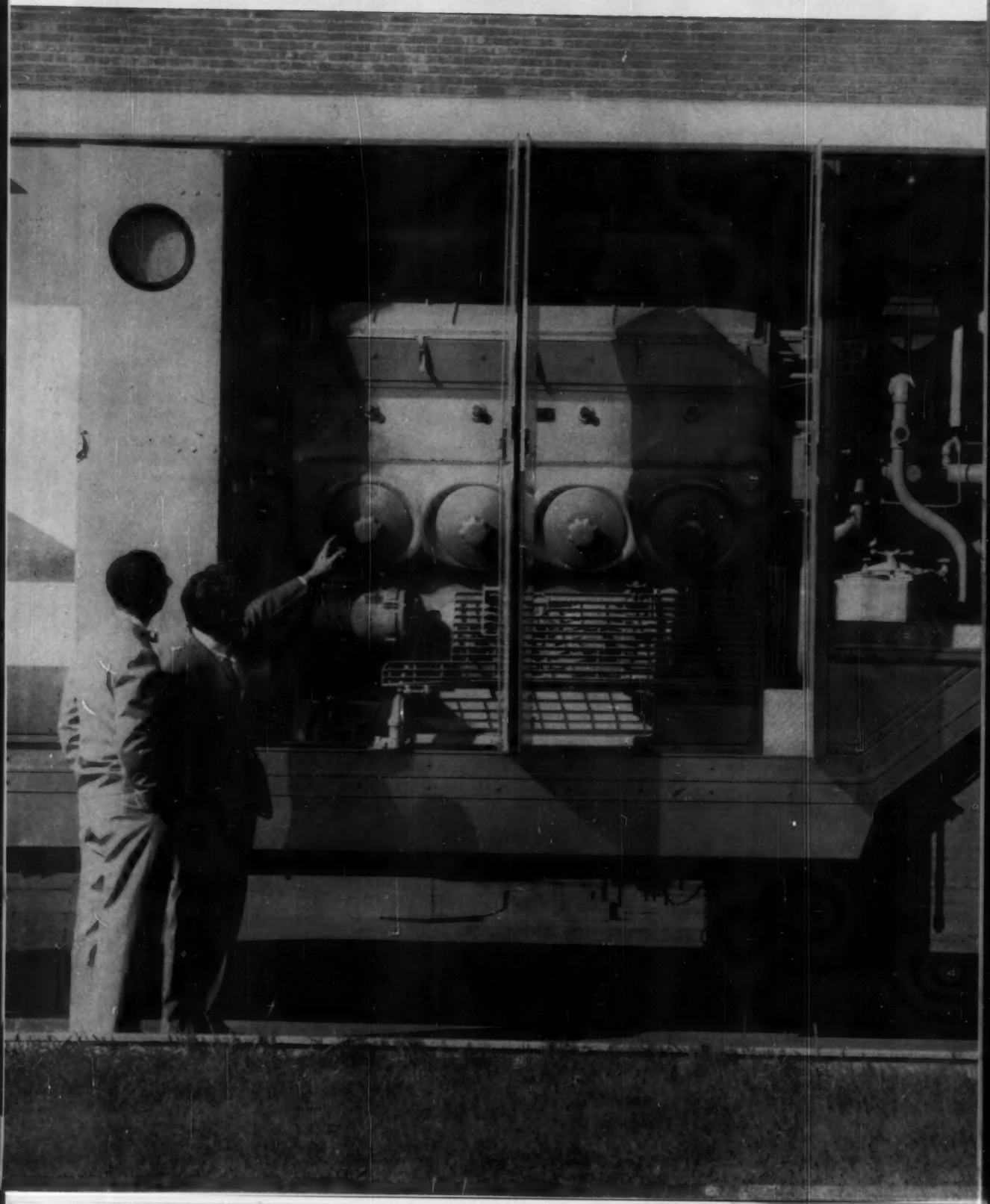
You, too, have much to gain from the proved reliability of Honeywell instrumentation and complete service follow-through. Your nearby Honeywell field engineer will gladly provide full details. Call him today . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.

Honeywell

First in Controls

Built only to



produce electric power

The Diesel engine was first designed and built for mechanical drive. It was much later that Electro-Motive incorporated this principle in designing and building a prime mover specifically for electric power generation.

It was, in fact, in 1932 that two experimental electric power generating sets were tested at the Chicago Century of Progress Exposition. These two cycle engines were a revelation in design —compact and lightweight.

Refined and improved over the years, this advanced prime mover has been produced in quantity by Electro-Motive—enough, in fact, for a total generating capacity of more than 24,000,000 kw. Above all, this engine has proved its dependability, operating for thousands of hours under every conceivable condition with only the most routine type of servicing.

It is this wealth of tested and proven experience that is your best assurance when you install Electro-Mobile equipment. Why not discuss its potential for low load factor generation with your Electro-Motive representative?

1000 kw units for use on sidings or placed on piers for semi-permanent use.

500 kw units offer excellent mobility for many temporary applications.

ELECTRO-MOTIVE DIVISION
GENERAL MOTORS

LA GRANGE, ILLINOIS

Sales offices in Chicago, New York, St. Louis, San Francisco
In Canada: General Motors Diesel Limited, London, Ontario

TAKE ALL YOUR MEASUREMENTS

the Modern Way

WITH A

Rolatape

MEASURING WHEEL

For estimating, layout, job checking—get your measuring done the fast, convenient way! Rolatape enables *one man* to measure off distance at normal walking speed, and the total is automatically recorded on instrument. Special counting mechanism assures accuracy. Rugged, yet lightweight, Rolatape folds compactly for easy handling.

The Model 400 measures and records total up to 19 miles.

Send Today for Complete Information:

ROLATAPE Inc.
1741 14th Street Dept. E-12
Santa Monica, Calif.

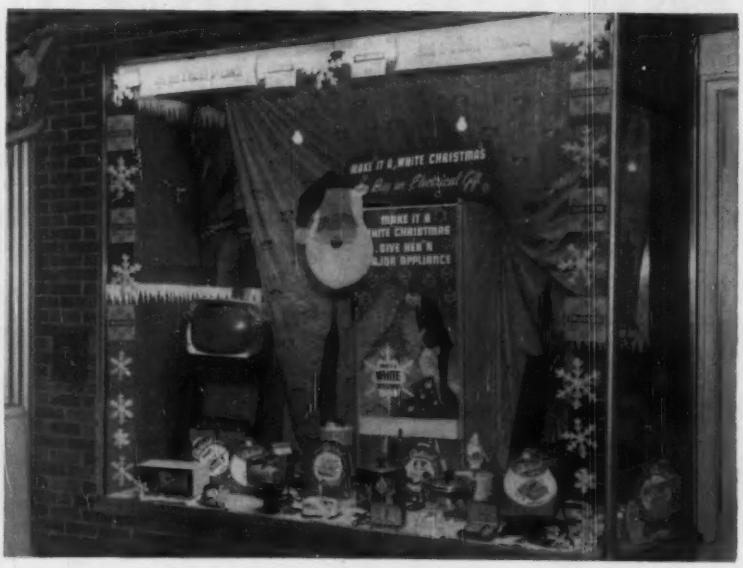
Send me free details on ROLATAPE:

NAME _____

FIRM _____

ADDRESS _____

CITY, STATE _____



UE Scatters Christmas 'Snowflakes'

Union Electric Co, St. Louis, is helping make it a "Snowflake" Christmas for many of its area appliance and housewares dealers. In doing so, the utility is lending local support to "Operation Snowflake," a United States Steel Co national marketing program designed to sell appliances as Christmas gifts.

Pictured above is the store window of F. A. Schmidt of St. Louis. The utility distributed both the "Snowflake" material and EEI's "Buy an Electrical Gift" material shown. The company also sent its sales people out to help dealers decorate their windows.

EEI Announces Awards for Sales Promotion

Edison Electric Institute has announced 12 new utility sales promotion awards to be offered next year.

The awards are for exceptional load-building activities in four markets: residential, farm, commercial, and industrial. The new awards are in lieu of those previously administered by EEI, which were for achievements in connection with specific appliances or selected market activities.

There are three awards in each of the four markets. Those for the residential, commercial, and industrial are based upon total number of meters. The three for the farm markets are based upon the number of farm customers. Idea behind such a subdivision of awards is to give all companies—regardless of size—a better chance to compete.

Brochures describing the awards and contests have been mailed. Additional copies are available from Secretary, Awards Committee, EEI, 420 Lexington Avenue, New York 17, N. Y. Deadlines for 1957 entries are Feb. 1 and 15, 1958.

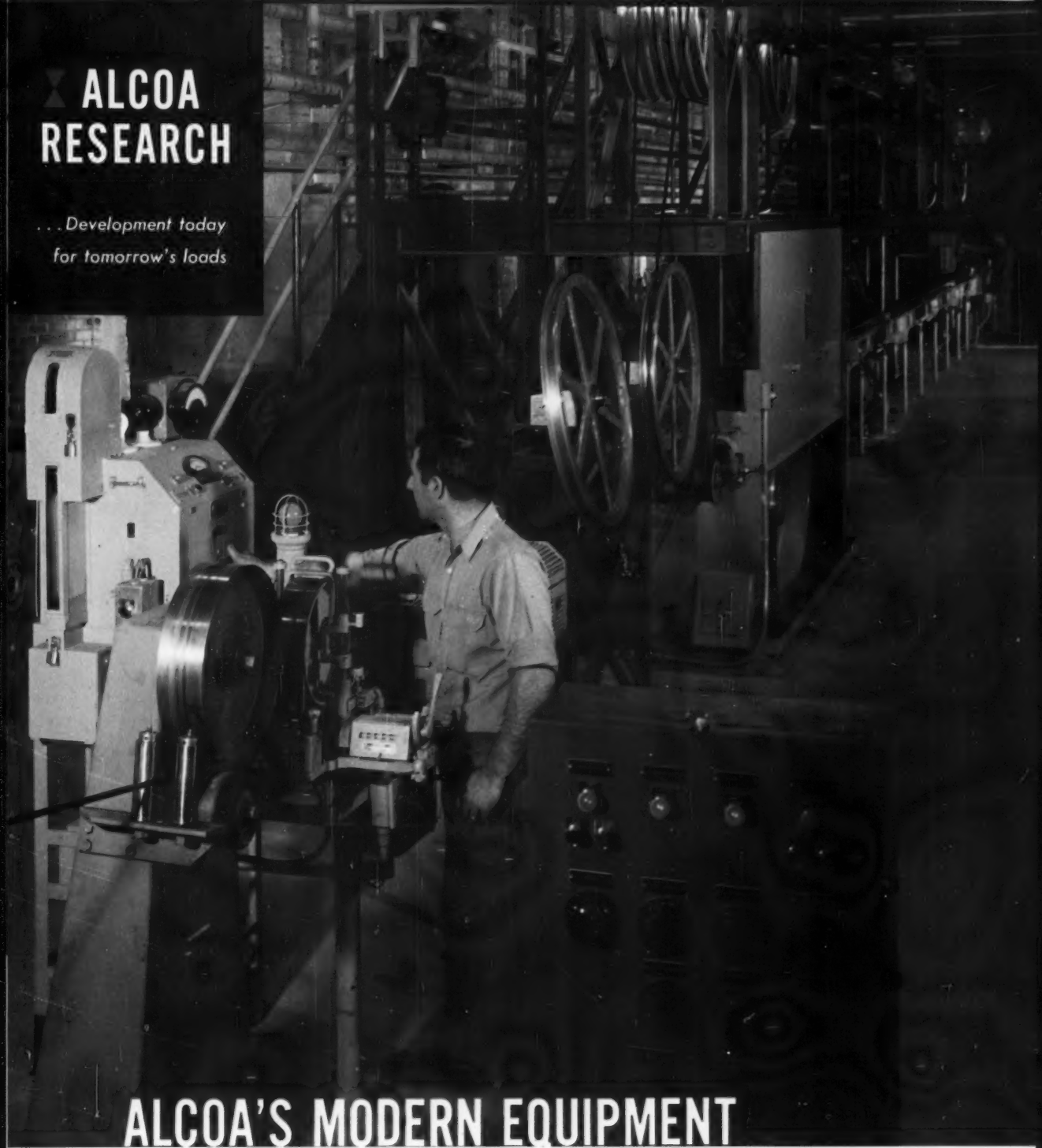
Book Helps Plan Wiring

A full and simple explanation of how to plan safe wiring will be available in November when McGraw-Hill Book Co publishes a "Wiring Manual for Home and Farm". The author, A. Carl Bredahl, is director of technical services of general advertising, Westinghouse Electric Corp, Pittsburgh, Pa.

(*More Selling on page* 135)

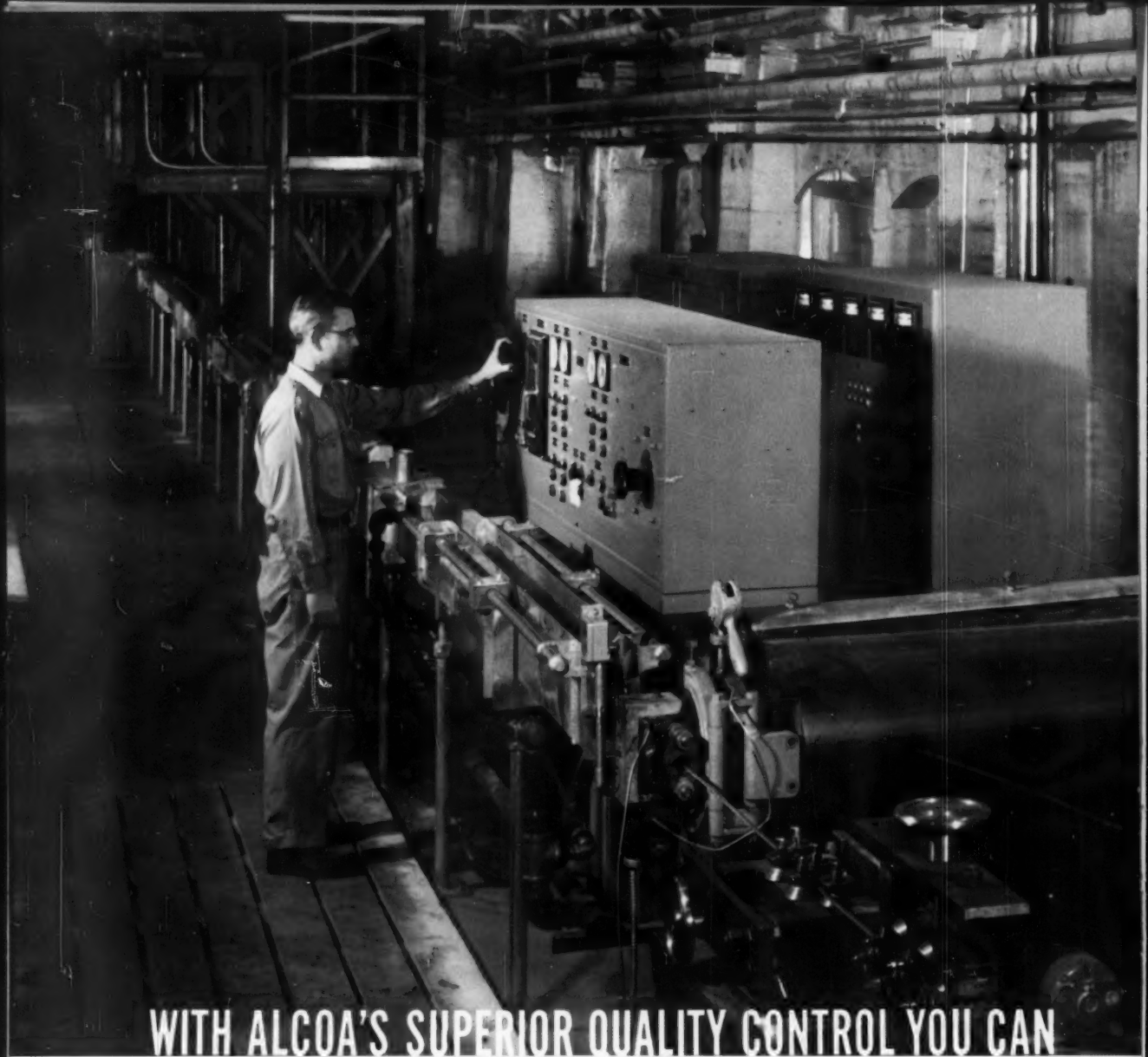
ALCOA RESEARCH

. . . Development today for tomorrow's loads



ALCOA'S MODERN EQUIPMENT PRODUCES PLASTIC-COVERED CONDUCTOR AT NEW MASSENA FACILITIES

The operator shown in the photograph on this page is adjusting the high-voltage tester through which all Alcoa plastic-covered conductor must pass before it is approved for shipment.

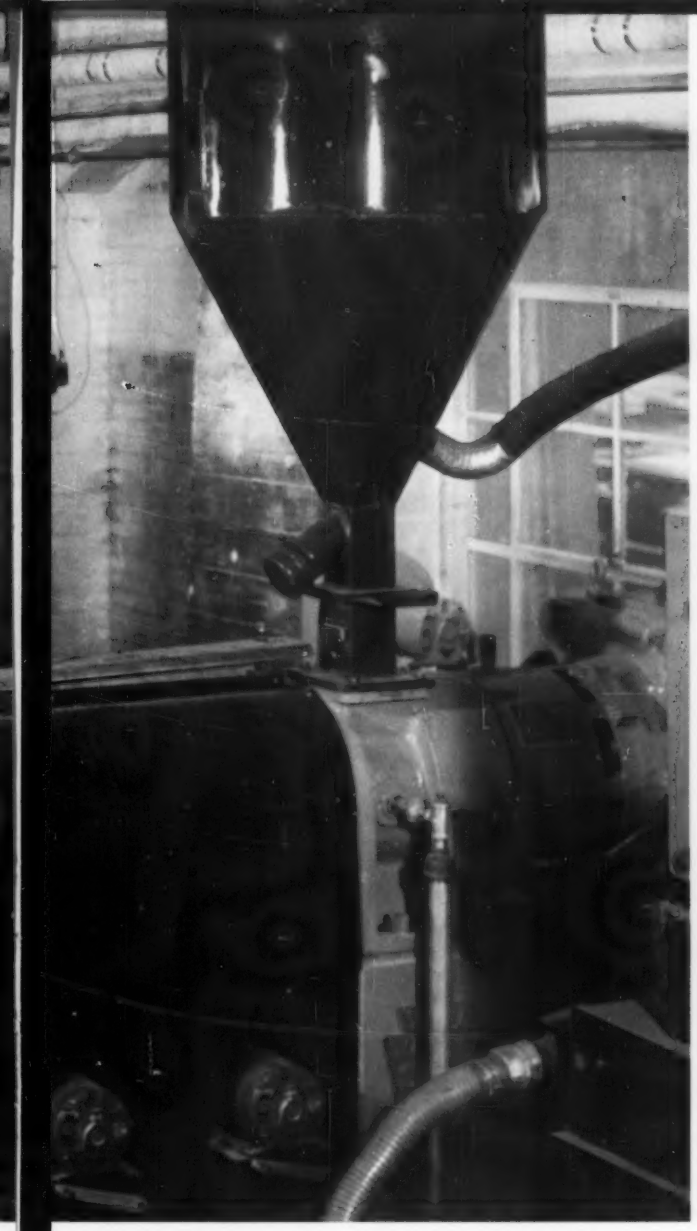


WITH ALCOA'S SUPERIOR QUALITY CONTROL YOU CAN GET PLASTIC-COVERED CONDUCTORS THAT MEET OR

Alcoa has established its own covered conductor department at Massena, N. Y., to enable customers to get the best service combined with the best quality. Alcoa's line of electrical conductors meets the most rigid standards. Using specially developed equipment, modern improvements incorporated in Alcoa's equipment assure the highest possible quality control over the finished covered conductor during production.

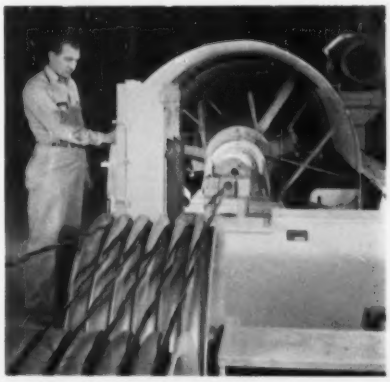
In the new manufacturing facility at Massena, quality is carefully controlled throughout the entire fabrication process. By putting the most modern and efficient coating equipment into the hands of the people accustomed to setting the standards of the aluminum conductor industry, a superior product is achieved.

The equipment is designed to apply coating to single wires, 7- and 8-strand and multilayered conductors. Insulated phase wires are



Precision controls on this plastic extruder line permit accurate control of the thickness of the covering. Coating such as standard polyethylene, high molecular polyethylene, high density polyethylene, P.V.C. (polyvinylchloride), etc., may be applied in any of the standard thicknesses or to your exact specifications.

This machine is wrapping triplex cable for self-supporting, low-voltage distribution and service drop use. Triplex consists of two insulated phase wires cabled usually with a bare neutral. Duplex employs one and quadruplex, three conductors, respectively.



Reels of covered aluminum conductor, foreground, are being checked before shipment from Alcoa's warehouse at Massena, N. Y. The "tires" in the background are actually coils of covered conductor packaged on a tire-wrapping machine for complete protection during shipment and storage. Each coil is provided with a ripcord for quick removal of the wrapping.

EXCEED ASA STANDARDS...

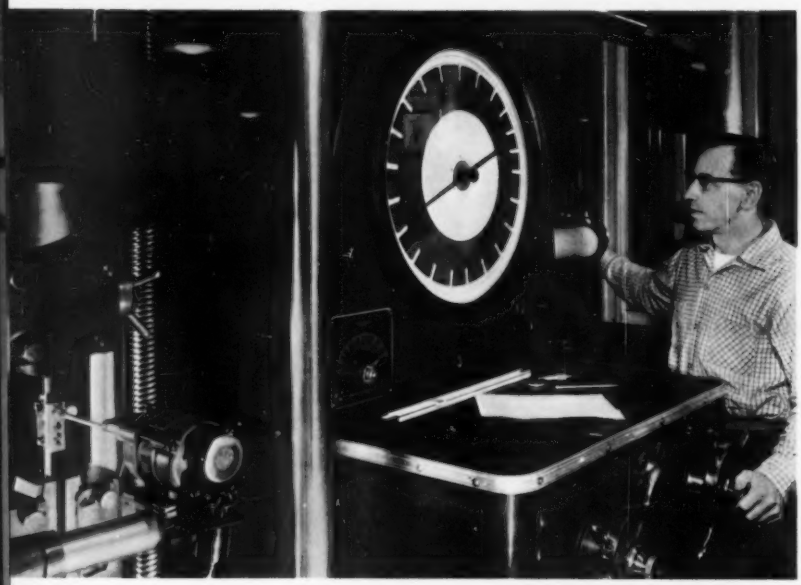
wrapped around bare or covered neutrals to form duplex, triplex or quadruplex service drop cables.

After their final winding into coils or reels, the cables are submerged in water to permit electrical testing for insulation imperfections. Sample strips of covering from the same lot undergo laboratory tests for thickness and composition. Only cables that pass this "acid test" are accepted for shipment.

ALCOA
ALUMINUM
ELECTRICAL CONDUCTORS AND ACCESSORIES
ALUMINUM COMPANY OF AMERICA

ALCOA RESEARCH
... Development today for tomorrow's loads

HOW THE ELECTRICAL ENGINEERING DIVISION OF ALCOA RESEARCH LABORATORIES SERVES YOU



The success of the Alcoa plastic-covered conductor program was assured by Alcoa's many years of experience as a producer of aluminum conductor. Exacting standards for aluminum conductors have long been a routine at Massena.

Here an aluminum sample rod is being placed under tension in a Baldwin 20,000-pound vertical testing machine. A strain follower has been mounted on the sample and a Selsyn motor is transmitting the sample's elongation to the recording drum near the operator's right hand.

The technician is removing the broken pieces of the rod specimen after it has been pulled apart in the tension test. This view shows the grips and heads of the testing machine. The results of such basic research appear in the uniformly high quality conductor Alcoa produces.

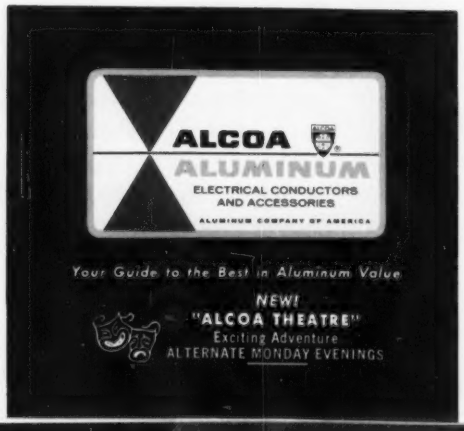
With the use of electrical energy in the United States doubling every ten years or less, there is a crying need for new and better products to serve that demand. Alcoa recognized this need in the early 1930's and set up a special division to concern itself with both the mechanical and electrical characteristics of products supplied to the electric power industry. With headquarters located at Massena, N. Y., it is known as the Electrical Engineering Division of Alcoa's Aluminum Research Laboratories.

In the large indoor laboratory at Massena, research is conducted on all problems involving the use of aluminum as a conductor of electricity. There are several outdoor test spans ranging from 200 to 1,500 feet. Wind conditions at Massena are favorable for the year-round study of aeolian vibration and galloping of conductors. In the winter, temperatures as low as forty below zero have been recorded, facilitating studies of cold weather behavior of conductors.

Extensive research and development are done on aluminum conductors and connectors. Accelerated tests are designed to simulate years of actual service conditions. This is accomplished by repetitive "on" and "off" periods of passage of electric current through the conductor, commonly known as "heat cycling." Inferior connections become excessively hot as the test proceeds. Similar tests are run in high humidity cabinets to obtain accelerated corrosion conditions in salt spray and other atmospheres.

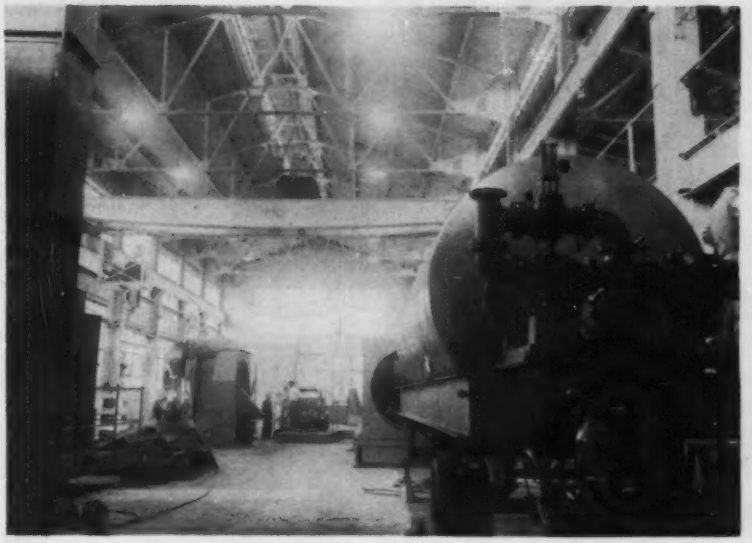
Out of this research and development program has come the best line of aluminum products for the electrical industry available anywhere. With the largest research and development program in the industry and a reputation for leadership, Alcoa offers you more. For assistance with any application of aluminum in the electric industry, see your Alcoa sales engineer or write Aluminum Company of America, 2307-A Alcoa Building, Pittsburgh 19, Pennsylvania.

ALCOA RESEARCH...*Development today—for tomorrow's loads*



New Lighting Puts End to Production Delays

PAUL KIMBALL, Lighting Sales Representative, Indianapolis Power & Light Co, Indianapolis, Ind.



16 kw of mercury lights raise illumination to 50 ft-c on floor, 175 ft-c six ft up. Foreground "shadow" area, caused by overhead pipe, measures 20 ft-c

"Production has increased 25% with 10% fewer man hours, thanks to the excellent lighting we now have," said John Smith, production superintendent of Hetherington & Berner, Inc, manufacturers of permanent and portable asphalt mills in Indianapolis, Indiana.

There has not been a "fall-down" on a shipping promise this year and the "10% behind" group from last year has been caught up. Smith believes that the lighting has been directly responsible for this increase in production, since there has been no change in personnel or in tools used. The only difference is that the work has been moved indoors and is done under excellent, controlled illumination. Furthermore, there has not been a charge-back on a production error since the new lighting went into operation.

Until December, 1956, parts were manufactured and assembled into minor sub-assemblies near the plant. The major part of the work was being handled in an outdoor erection yard.

Walls Painted Pastel Green

The 10% fall-downs were a continuing struggle, resulting in overtime work and loss of good customer relations. When management discovered that the majority of "fall-downs" were caused by weather interrupting the work in the outside erection yard, they decided that all work except the final assembly in the field should be moved indoors, where it could be done under controlled conditions without being affected by weather.

For this purpose, an old foundry building, 40 ft by 200 ft with a 35-ft ceiling, was obtained. The interior was sand blasted and wire brushed. Walls were painted a matte-finish pastel green.

The management consulted the Indianapolis Power & Light Co, who planned the lighting system. Recommendations were backed up with a "cost-of-light" comparison and emphasis on the contribution that good illumination could make to profits.

Sixteen kw of mercury lighting were installed to provide a 50-ft-candle level on the floor of the building. Lighting level is 75 ft-c three feet above the floor and 125 ft-c six feet up.

The speed of seeing and the accuracy required to avoid expensive "charge-backs" make the new illumination an important tool for the erection crews, accustomed to working in sunlight. Even when several welding machines are being used, there is no appreciable loss of light on other jobs. Adjustable spotlights, set up to provide supplementary lighting for the welders, are seldom used because the general lighting provides such a high, even illumination.

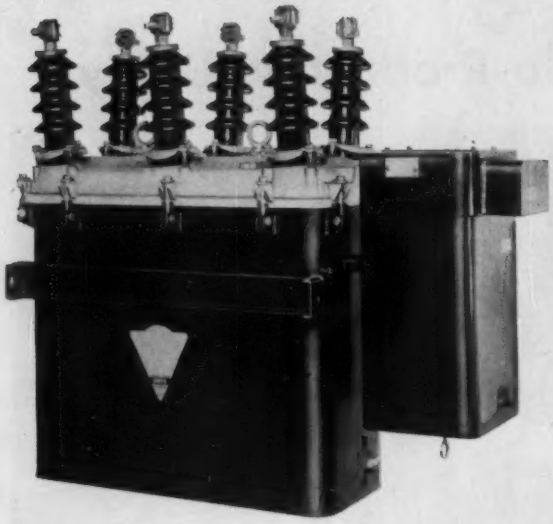
Superintendent Smith says, "We have good lighting in the office so that any mistakes can be found and erased at once with little cost. In production, a mistake in seeing can cost us thousands of dollars and weeks of time. We are going to have office levels of lighting in all our production areas. This experience has proved its value to us."

Infra-red Steps Up Shoe Relasting

NORMAN HARTMAN, Power Sales Engineer, Pennsylvania Power & Light Co, Columbia, Pa.

Infra-red radiant heaters used to dry shoes after relasting have cut drying time and improved product uniformity at the A. S. Kreider Shoe Co in Elizabethtown, Pa. In addition to a low initial cost, the units require little maintenance and take up a minimum of valuable floor space. Shoes which have been dipped after relasting for final finishing can now be dried in a few minutes. Previously, they had to be allowed to dry for 24 hours before the next operation could take place.

NEW EQUIPMENT



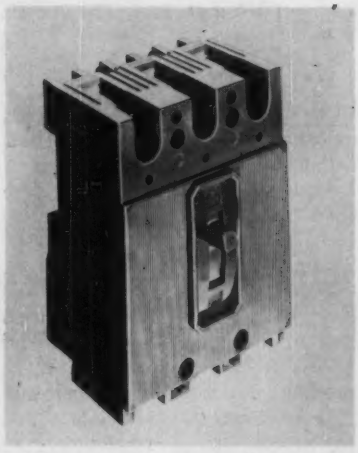
Oil Switch . . .

. . . for capacitor step-switching limits high-frequency inrush currents. The 400-amp switch is rated at 15 kv and 110 kv BIL. Motor-driven mechanism allows remote electric operation.

Resistors in series with arcing contacts limit high-frequency transient currents from energized capacitors trying to discharge into adjacent de-energized capacitors. Separate load contacts provide positive, low-resistance current transfer.

Applicable to systems with phase-to-phase ratings of 14.4 kv and below, "VCR" oil switches can handle 300 amp of capacitive current. Momentary and latching ratings are 20,000 amp asymmetrical. Four-sec. rating is 6,000 amp symmetrical.

Line Material Industries, McGraw-Edison Co, Milwaukee 1, Wis.



Circuit Breaker . . .

. . . for 400-v ac service takes little mounting space. Designated "EH" frame, it is available in 2- and 3-pole construction in molded case. Continuous current ratings are 10 to 100 amp; interrupting rating is 10,000 amp.

Coordinated thermal-magnetic operating characteristics, common tripping, quick make-quick break operation, and a three-position operating handle are among its features. Breakers will also take 250 v dc.

I-T-E Circuit Breaker Co, Small Air Circuit Breaker Div, 19th & Hamilton Sts, Philadelphia 30, Pa.

Capacitor Hanger . . .

. . . is six-unit type for 25- or 50-kvar capacitors 7960 v or less. The 22-lb corrosion-resistant hanger can be mounted direct to pole with one or two bolts. Two-section construction allows bracket to be fastened to pole while capacitors are being secured to mounting angles on the ground. After cable connections are made between units, this assembly can be hoisted and bolted to bracket.

General Electric Co, Capacitor Dept, Hudson Falls, N. Y.

Service Entrance Mast Kit

. . . includes all parts needed for permanent installation on one-story buildings: service entrance head, roof plate and flashing, mast support, offset reducer, and wireholder. Neoprene storm collar on combination roof-plate and flashing renders caulking unnecessary. Slip-fit design means quick installation. Mast will withstand 2,600-lb pull.

Crouse Hinds Co, Wolf & 7th North Sts, Syracuse 1, N. Y.

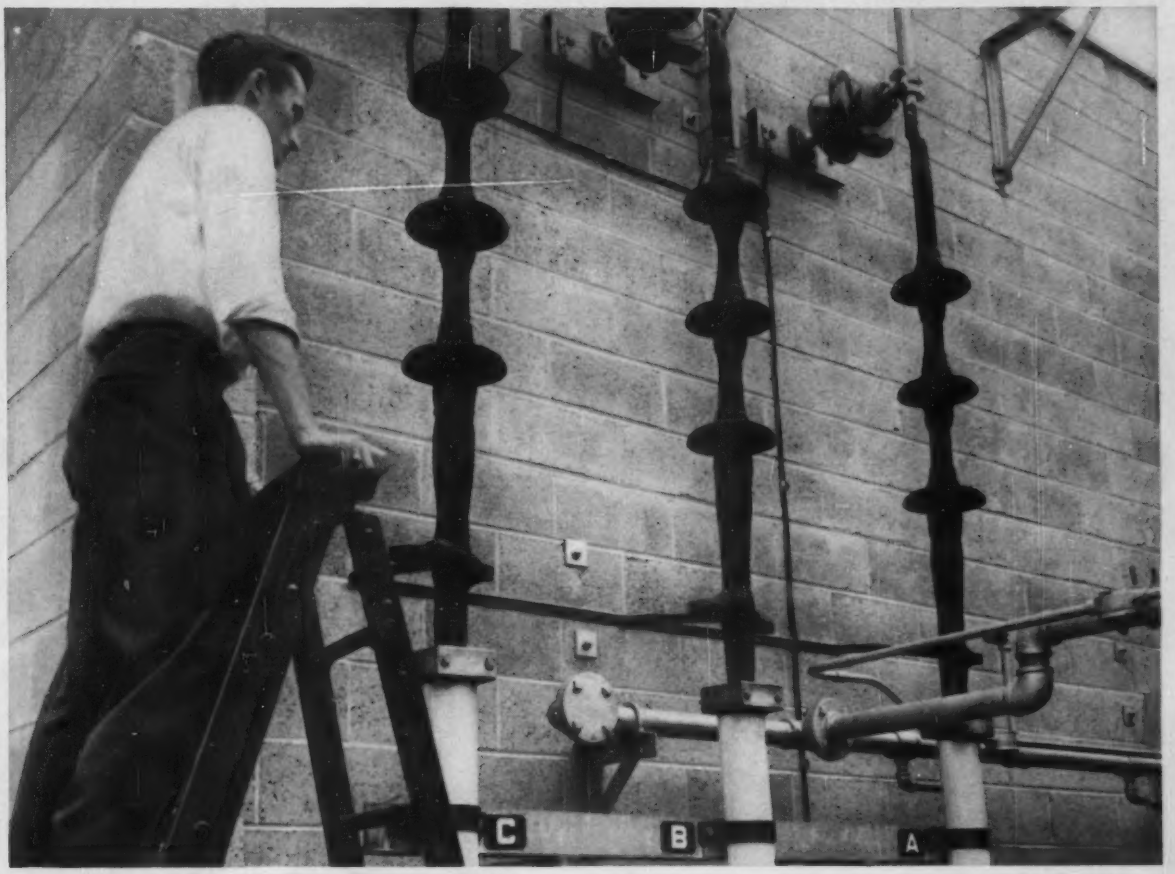
Insulating Compound . . .

. . . comes in tape form. Conforming to irregular shapes, it pads sharp corners around terminals, connections, bus bars, and motor lead junctions. After application and shaping into place it forms a smooth surface for overwrapping.

Permanently plastic, the compound resists acids and alkalies, and can take 160F. Dielectric strength averages 445 vpm. Rolls are 1½ in wide, ⅛ in thick, and 5 ft. long.

Johns-Manville Dutch Brand Div, 7800 S. Woodlawn Ave, Chicago 19, Ill.

(*More New Equipment on page* 140)



FOR TRANSFORMER LEADS

Philadelphia Electric protects cable with neoprene jacket and neoprene tape

Philadelphia Electric Co. puts the protective properties of neoprene to use in two ways at its Wynnewood Substation. The 38 Kv cables used as transformer leads are jacketed with neoprene. And neoprene tape is used at the terminations.

The cables, which connect the transformer to buses, are both rubber-insulated and shielded, with an extruded neoprene jacket. The cables run through ducts which often have water standing in them.

The Wynnewood Substation is one of the first to make use of neoprene tape on 38 Kv terminations. Here the tape is used to prevent deterioration due to weathering and a high concentration of ozone.

This is added proof of neoprene's wide acceptance for cable and wire jacketing. Of all resilient materials, only neoprene has a balanced resistance to ozone, sunlight and weathering, oils and chemicals, heat, flex cracking, abrasion and cutting, oxidation and aging.

Ask your supplier about wire and cable jacketed with neoprene. It's available in single and multiple conductor types and voltage ratings to meet your requirements. Mail the coupon below to get the ELASTOMERS NOTEBOOK with actual on-the-job reports of neoprene's performance in a wide range of industrial products.

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. . . through chemistry

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Wilmington 98, Delaware

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City, State_____

MAIL THIS COUPON NOW . . . WHILE YOU'RE THINKING ABOUT IT

Helping the industry meet its growing loads

Westinghouse Pioneers cost-saving unit for Bergen Generating Station

ELECTRIC UTILITY EXECUTIVES are taking a thoughtful look at the lower capital cost and long-range savings brought about by a new 290-mw Westinghouse cross-compound turbine-generator. Pioneered in conjunction with the Public Service Electric and Gas Company, *two* of these Westinghouse units will soon be installed in the Bergen (N. J.) Generating Station.

The double 3600-rpm cross-compound arrangement, developed for this installation, allows a degree of standardization of components talked of but never before realized in the race to larger and larger machines.

Lower capital and operating costs will be realized by the unusual arrangement of the components. For example, *duplicate* generators and *duplicate* switchgear are used because the load is split evenly between the 3600-rpm shafts. About $500,000 is saved in this plant's first cost, through the unique method of powering the boiler feed pumps by the generator shafts.

Station costs will be lower because the time-proven components in this new machine are lighter and smaller than in other cross-compound turbine-generators.

This new Westinghouse concept for a large turbine-generator clearly demonstrates that Westinghouse continues searching for . . . and succeeds in discovering . . . new and more economical designs to help the industry meet its growing loads. J-97214

◀ Model of one of the two Westinghouse 290-mw turbine-generators designed for the Bergen Generating Station. Unusual feature: boiler feed pumps are driven by the shafts of the duplicate generators. L to R: W. C. Wood, Westinghouse Newark District Manager with J. R. Carlson, Manager of Engineering, Westinghouse Steam Division, South Philadelphia Works.

Five other utilities order this new turbine-generator

Since the original order from Public Service Electric and Gas Company, the following utilities have ordered turbine-generators similar in design to the new Bergen machine: Alabama Power Company, Consumers Power Company, Pacific Gas & Electric Company, Pennsylvania Power & Light Company and Southern California Edison Company.

Highlights of new Bergen design

- Two equally rated 3600-rpm generators
- Boiler feed pumps powered by the main generator shafts
- Small tried and proven components

These are the features of the new 290-mw cross-compound, quadruple flow, reheat turbine-generator which will use an inlet steam pressure of 2350 psig, and initial temperature of 1100 F with one reheat to 1050 F.

Fewer spare parts

The equal load split between the two 3600-rpm shafts results in *duplicate* generators and *duplicate* switchgear. The LP turbine elements are also *duplicates*. Because so many parts are common, fewer need to be stocked for spares.

About $500,000 saved in this plant's first cost

. . . for the two machines soon to be installed in the Bergen Generating Station. Through an unusual arrangement, the boiler feed pumps are driven by the generator shafts, eliminating the need for motors and control for these pumps. This arrangement, of course, also cuts requirements for auxiliary electric power.

Time-proven components

The use of conventional Westinghouse components in these large turbine-generators assures continued high level efficiency.

Lighter foundations, less space . . .

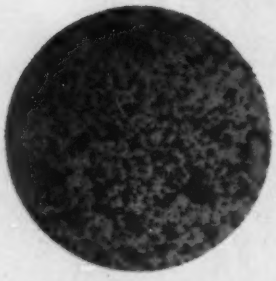
. . . less crane capacity and headroom and lower shipping and handling costs. The two high-speed shafts permit the use of smaller and lighter components than are used in conventional 3600/1800-rpm cross-compound machine.

YOU CAN BE SURE...IF IT'S

Westinghouse

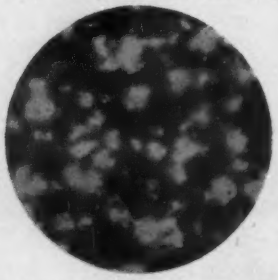
HOW SUBOX PAINTS ACTIVELY COMBAT CORROSION

Subox paints go far beyond the passive protection of inert paints. The chemically-active suboxide of lead in Subox paints actually works continuously to combat corrosion, as illustrated by these photomicrographs:



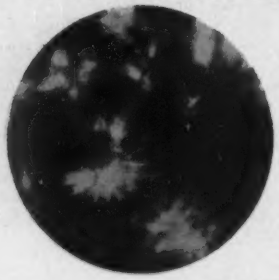
LEAD-SUBOXIDE PARTICLES

Lead-suboxide is a colloidal pigment which assures maximum penetration of a surface . . . packs to form a dense, impervious film. Two coats of Subox usually give the coverage of three of other paints . . . often, one coat of Subox is enough.



FIELD OF LEAD SOAPS

As soon as Subox is dry, lead-suboxide begins to react with the fatty acids of the vehicle to form insoluble lead soaps whose fibers bear metallic lead. These fibers intertwine to continuously build up a reinforcing film of protection.



FIBROUS STRUCTURE OF LEAD SOAPS

The fibrous film gradually strengthens and replaces the original vehicle film which otherwise would have become brittle and have largely lost its protective power and adhesion.

Subox paints are the only American paints made with lead-suboxide. They are economical to apply, endure for years and largely eliminate the need for scraping and repriming when repainting is required.

Write for the brochure "Subox Paints".

SUBOX PAINTS

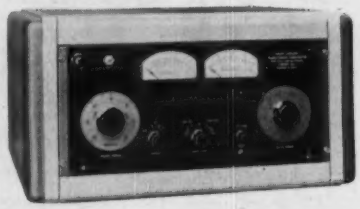
Subox Inc.
*Trade Mark

Established 1924
3 Fairmount Plant
Hackensack, N. J.

Portable Gas Alarm . . .

. . . for tunnels under streets and similar applications gives audible warning of combustible gases, has visible indicator meter also. Externally-mounted plug-in filament unit assures rapid response.

The gas alarm is light because battery charger is separate. Remote detector, alarm light, and sample-drawing attachment are optional.
Johnson-Williams, Inc, 2738 Park Blvd, Palo Alto, Cal.



Comparator . . .

. . . for current transformers is unaffected by stray fields, harmonics, and heavy overload test currents. With self-contained ammeter of 1-, 10-, and 20-amp, transformer burden is less than 0.1 va.

Normal full-scale error ranges are 0.64% in ratio error with 0.01% divisions, and 35 min. in phase error with one-min. divisions. Range switch affords multiplying factor of ten. Ratio and phase errors are measured simultaneously and are direct reading.
Knopp Inc, 1307 66th St, Oakland 8, Cal.

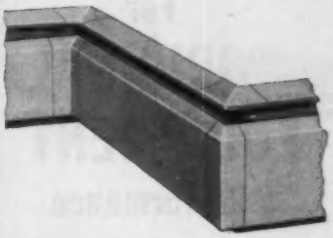
Cable-Fireproofing Tape . . .

. . . withstands water, acids, alkalis as well as fire. Made of silicone-impregnated asbestos, it is applied dry. Designed to protect cables in circuits with fast-acting breakers, it stays strong after burnout. It also resists oil, fungus, and mold; does not sag or droop.

Samples soaked in water and heated to 500F tested above 60 lb average breaking strength, and above 50 lb minimum individual breaking strength.
Johns-Manville Corp, Dept TX-6A, 22 East 40th St, New York 16, N. Y.

(*More New Products on* 142)

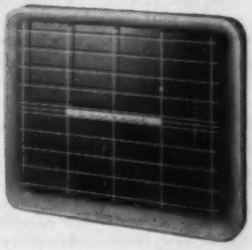
Need compensating winter load?



Chromalox Baseboard Heater

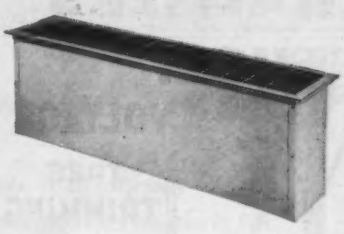
Chromalox
Electric Unit Ventilator

Chromalox
Automatic Wall-Insert Heater



Chromalox
All-metal Radiant Panel

Chromalox In-Duct Heater



Chromalox Floor Drop-in Heater

Chromalox Hi-Flow Portables

It's here...with Chromalox

The full quality line

Those summer peaks seem to be growing more acute for more and more utilities every year. Fortunately, there is an ideal compensating winter load available now—it's electric comfort heating, for home, commerce and industry. It appears to present the greatest load building opportunity to date.

Its load characteristics are favorable, too—unity power factor, good diversity, large KWH use, and favorable time of daily peak.

It fits all markets, also—new homes, existing homes, remodeling, conversion, and auxiliary heating. Quality products for this quality market are already available to produce the genuine heating comforts and benefits that only electricity can provide.

Write now for complete literature, promotional plans and workshop information, so America can:

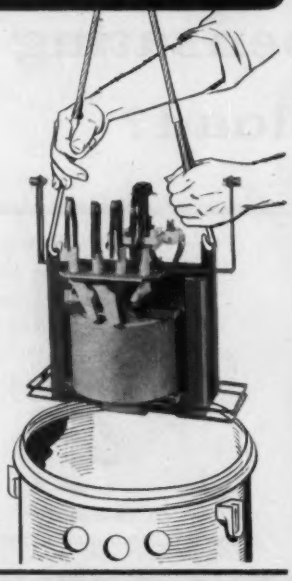
HEAT BETTER—ELECTRICALLY

C-2207

Chromalox Electric Heat
Edwin L. Wiegand Company
7780 Thomas Boulevard, Pittsburgh 8, Pennsylvania
CHurchill 2-6400
See our complete line in Sweet's Catalog

For
"ORIGINAL EQUIPMENT"
Performance

ALLIS-CHALMERS
CORE and COIL
Replacement
Assemblies



THESE replacement units feature the same craftsmanship, high grade materials and quality control that have made Allis-Chalmers transformers preferred equipment. Assemblies are thoroughly dried in controlled ovens, tested, and sealed in a metal container filled with high grade transformer oil.

Compact design permits up-rating of old units. Adjustable anchoring arrangement assures accurate fit. Provisions for mounting low voltage breaker and winding for signal light are standard.

Get all the facts on these new light weight — easy to install units. See your A-C representative or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

A-5499

ALLIS-CHALMERS

INDIANA STEEL & WIRE CO. Crapo Galvanizing MUNCIE, IND.

Signs along the lines of *Crapo* GALVANIZED STEEL STRAND PERFORMANCE

For dependable performance . . . insist upon *Crapo* Galvanized Steel Strand. Superior tensile strength, combined with long-life, ruggedness and workability, makes *Crapo* Steel Strand first choice for guys, messenger and overhead ground wire.

The famous *Crapo* galvanizing process provides dependable protection for the steel, prolongs the expectant life of the strand.

- Low maintenance cost
- Laboratory tested and controlled quality
- Meets highest quality standards
- A size and grade for all practical needs
- Contact your *Crapo* Jobber Today!

INDIANA
STEEL & WIRE CO., INC.
Muncie, Indiana

HIGH VOLTAGE TREE TRIMMING has been made Safe with BARTLETT INSULATED TRIMMERS

Bartlett No. 1-B Bakelite Insulated Tree Trimmers—tested to withstand 105,000 volts—are extensively used by all leading utilities because of their safety factor.

STRONG, EFFICIENT

Laminated Sitka Spruce poles and finest tool steel blades insure ample strength and long service.

Compound lever action cutting head easily severs limbs to 1¼".

For the best and safest in Trimming Tools write for new Public Utilities catalog.

BARTLETT MFG. CO.
3048 E. Grand Blvd., Detroit 2, Mich.

MORE NEW PRODUCTS

Industrial lamp for close work throws intense spot adjustable from ⅝-in. to 3-in. diameter. Illumination is free from shadows.—Edmund Scientific Co, Barrington, N. J.

Round-chart **speed-deviation recorder** is accurate to 0.1%, unaffected by vibration.—General Electric Co, Schenectady 5, N. Y.

Compact **motor-starter housings** are explosion-proof, dust-tight, and weather-resistant. Cadmium-plated throughout, the air-break-type enclosures are available for 1½ to 100 hp.—Pyle-National Co, 1334 N. Kostner Ave, Chicago 51, Ill.

Oblique plier has replaceable shear cutting blade.—Mathias Klein & Sons, 7200 McCormick Rd, Chicago 45, Ill.

Recessed **troffers** for use in exposed "T" furring and Acousti-Line ceilings in stores, offices, schools, and public buildings offer 100 fixture types from three troffer sizes.—The Miller Co, Dept PR-10, Meriden, Conn.

Magnetic contactor, available in sizes "0" through "5", permits all parts to be inspected when cover is snapped open. Coil maintenance is also simple.—Rowan Controller Co, 2315 Homewood Ave, Baltimore 18, Md.

(*More New Products on page* 144)

COATES Field Service, INC.
P. O. Box 1581 Okla. City
Thoroughly Specialized
RIGHT-OF-WAY ACQUISITION
From Title Search . . . To Damage Claims

3 Legs Make Twice the Derrick

With Holan's three-legged derrick, you are ready for any job at a moment's notice... butt-pulling... body-loading... extra-heavy lifts.

The integral third leg means crews won't have to sit idle while a separate third leg is being attached. And the integral third leg gives extra strength to provide a wider and safer working range.

This derrick was designed to do more than it has to. It lifts loads up to 12,000 pounds, poles 75 feet long . . and has been load-tested at 22,000 pounds. For body loading, it hoists up to 5,000 pounds of equipment over the rear axle. Working range is 195° — the derrick head lowering to within five feet of the ground. Two levers at the rear of the truck body hydraulically control the derrick and live boom.

There's nothing else in the field like Holan's Series 3700 Live-boom Power Derrick.

Write for the Series 3700 catalog.

J. H. HOLAN CORPORATION

4100 WEST 150TH STREET
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BRANTFORD-HOLAN LIMITED, Brantford, Ontario

THE NAME THAT MEANS WORK SIMPLIFICATION

Line construction bodies for light to heavy-duty. Crew compartments optional. Efficient tool compartments and drawers.

Bodies for truck driven air compressors. Designed to accommodate hose reels, tapping machines, jack hammers, etc.

Service bodies for chassis up to 1½ ton. Lengths, 72", 75", 84", 90" and 102".

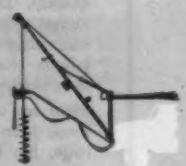
Hydraulic Derricks designed for front or rear mounting. Capacities to 12,000 lbs.

Light-duty power operated derricks for front or rear mounting. Operating range of 146°.

Ladders to 40' with all phases completely hydraulic. Pump actuated by P.T.O. or separate engine drive with electric starter.

Mechanical Ladders expertly engineered and counterbalanced for effortless handling. Maximum heights from 23' to 40'. Swings 360°; angles to 72°.

Portable hydraulic and mechanical earth borers. Augers for 8" to 20" diameters, depth to 8'.



Wide variety of pole and reel trailers. Standard and special. Many optional features.

Hydraulic jacks, controlled from rear of truck. Rigid mounted or patented Holan self-stowing types.

Hydraulic towers with rotary, stationary, or transverse platforms. Exclusive box-girder telescoping mast.

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ELECTROMODE

Automatic Electric

PORTABLE HEATERS

Instant Heat — Wherever Needed

These powerful new heaters give abundant fan-circulated heat for big rooms, safely and quickly. Enable the family to use the whole house, anytime. Equipped with a 6-foot cord and plug and convenient carrying handle. Built-in thermostat provides automatic room temperature control.

Ideal for use in basement game room, work shop, laundry; expansion attic; cottage; garage; big hard-to-heat rooms.

Model	Cat. No.	Volts
PA-32	3995-S	240
PA-36	3995-T	208
PA-48	3995-U	240

NEW DESIGN
Modern Streamlined

NEW COLOR
Tutone Driftwood

NEW CAPACITIES
3200, 3600, 4800 watts

100% SAFE because of the completely sealed-in, cast-aluminum heating element—an Electromode exclusive feature. There are no open wires and no glowing coils, and there is no danger of fire, shock or burn. Equipped with automatic safety switch and quiet heavy duty motor.

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For more than a quarter century Electromode has concentrated on one specific industry—heating by electricity. And Electromode has continued to expand its line to include the most modern developments in electric heating equipment to serve the needs of HOME-INDUSTRY-FARM.

SEND FOR FREE descriptive literature with complete specifications.

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45 Crouch Street
Rochester 3, N. Y.

Spring-return, proportional-type **motor operator** for control of dampers in heating and cooling systems and industrial applications has gear train and drive submerged in oil and sealed in die-cast case.—Barber Colman Co, 1300 Rock St, Rockford, Ill.

Medium-duty sectional **terminal blocks** may be assembled on-the-job without fastening hardware.—Buchanan Electrical Products Corp, Hillside, N. J.

Germanium **power-rectifier junctions** for high-current, low-voltage duty carry 500-amp rating, are 98.9% efficient.—International Rectifier Corp, El Segundo, Cal.

Insulating tape for temperatures from —55C to 180C has glass-cloth backing coated with thermosetting silicone adhesive.—Minnesota Mining & Mfg Co, Dept D7-347, 900 Bush Ave, St. Paul 6, Minn.

Compact truck-mounted **air compressor** is driven from truck engine through power take-off. Weight (with take-off) is 915 lb.—Davey Compressor Co, Kent, Ohio

Insulating varnish and **wire enamel** when used together withstand 180C hotspots, yet varnish cures at 290F to 325F.—Schenectady Varnish Co, Inc, Schenectady, N. Y.

Plug-in **busway** provides 100-amp outlets over wide area. Applications include industrial plants and laboratories. Rated 600 v maximum.—Distribution Assemblies Dept, General Electric Co, Plainville, Conn.

Oscilloscope measures only 8x12¼x 16½ in., has 5-in. screen and universal-fit bezel.—Simpson Electric Co, 5200 W. Kinzie St, Chicago 44, Ill.

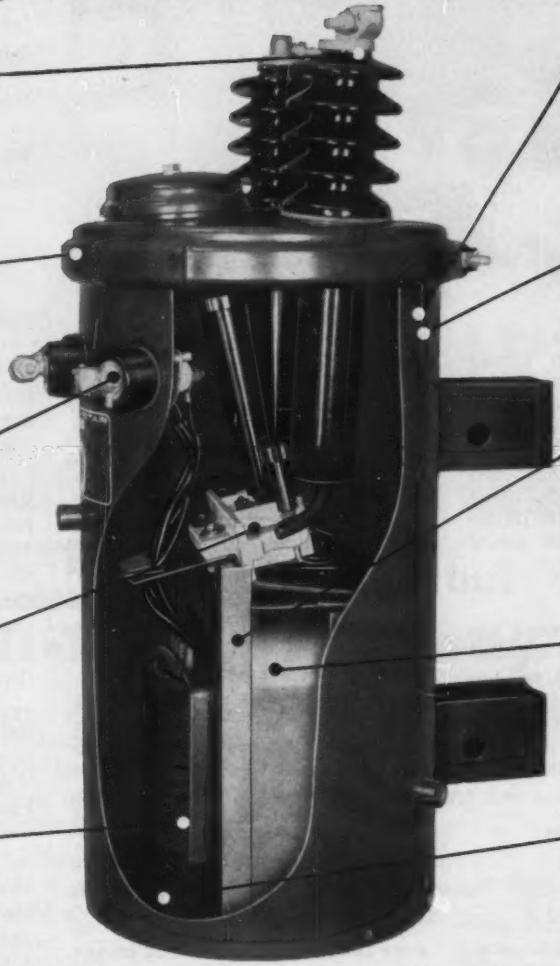
Door-operated 200-amp **main service switch** is 3-pole, 2-fuse, solid neutral, 120-240-v ac type.

Split-bus **circuit breaker enclosure** is for 100-amp service, 3-wire, solid neutral, 120-240-v ac.—Wadsworth Electric Mfg Co, Inc, Covington, Ky.

(*More New Products on page* 146)

HERE'S HOW DELTA-STAR DISTRIBUTION TRANSFORMERS*

offer lighter weight, easier maintenance, and improved core



BUSHINGS
Double-keyed—connector to porcelain—porcelain to tank. Assures positive lock against rotation.

COVER
Assures positive seal—and natural shedding of water. One-piece non-corrosive clamping band with re-usable nitrile rubber gasket.

TERMINALS
Tin-plated bronze alloy. Spring loaded to accommodate aluminum or copper conductors.

TAP CHANGER
Positively positioned. Liberal voltage-creepage distance. Handle grip above oil. Shorting bar under spring tension.

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Wound with liberal insulation. Heavy Formvar wire. Ducts provide maximum, uniform cooling.

TANK
Design minimizes number of external parts. Pressure-tested for perfect sealing. Reinforced bottom edge.

FINISH
Provides maximum corrosion-protection. Special metal preparation prior to alkyd painting. All primer and finish coats baked.

CORE-COIL ASSEMBLY
Will not shift under severest handling conditions. Securely anchored to tank wall. Positively braced against short circuits.

PORTER CORE
Grain-oriented, cold-rolled silicon steel. Assures low losses, smaller tank, minimum weight.

INHIBITED OIL
Gives extended life with better insulating characteristics. Specially processed immediately before filling.

With single phase ratings from 3kva to 167kva, in standard voltages through 15,000 volts, this complete line of Delta-Star Transformers embodies the latest developments in transformer design . . . a pole type built to fully meet NEMA standards.

Send for 16-page illustrated catalog. **Write to H. K. Porter Company, Inc., Delta-Star Electric Division, 17th and Cambria Streets, Philadelphia 32, Pa.**

***PATENTS APPLIED FOR**

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Porter Divisions: Cleveland, Connors Steel, Delta-Star Electric, Henry Disston, Leschen Wire Rope, Quaker Rubber, Refractories, Riverside-Alloy Metal, Vulcan Crucible Steel, W-S Fittings, H. K. Porter Company (Canada) Ltd.

Continued from page 58

Another L&N solution to the area regulating problem

FP&L's H. W. Page and O. H. Bridges discuss new control center layout.

and, in 1951, Page predicted** a type of computer which closely matches the one now being built for his system. For example, he foresaw today's function generator which enables the computer to digest — and remember—the cost characteristics of each unit. The prediction went so far as to visualize the physical outline of some of the major computer-control components.

Building Block Approach

As a result, FP&L's planned approach to computer-control included installation of its present Area Control in 1955. It was a nicely planned move, for the control arrangement was well suited to future requirements—including the integration of an analog computer.

All Major Generating Sources Now Under Control

With its present Area Control, FP&L has all eight major plants—plus four ties with the Interconnected System — under automatic control. The control has sufficient flexibility not only to make lowest cost of generation possible, but also to permit automatic operation during the morning pick up as well as during periods of adverse conditions when it may be necessary to depart from economic loading to meet customer load demand.

Adequate Feedback

A big reason for success of the control is the positive feedback of all significant control intelligence, including unit and station response to control signals. With regulating units moving in unison along their respective incremental cost curves, "hunting" among units and stations is eliminated—and with it, the unnecessary generation changes (including resultant dollar loss) which could occur if units were to respond to anything other than the basic (area) requirement.

The Operating Man: Guide to Lower Costs

In light of the work now in progress in Miami and other control centers around the country, we of Leeds & Northrup want to suggest that the operating engineers on your own system are your best guide to more economical, more reliable control. We find that when they review all the facts, they specify control by control specialists.

Let us send you the facts on some 40 typical Area Control installations as described by the utility company engineers who operate them. Just write to Leeds & Northrup Company, 4918 Stenton Avenue, Philadelphia 44, Pa.

****From a talk delivered to the Southeastern Electric Exchange, March 29, 1951. "Loading of Power Plants for Maximum System Economy."**

Magnetic **hoist-motor control** for a-c motors has eddy-current brake.—Northern Engineering Works, 210 Chene St, Detroit 7, Mich.

Compact vertical-action **starter** features screwdriver-changing of coil, contacts, and overload relays without disturbing external connections.—Square D Co, 4041 N. Richards St, Milwaukee 12, Wis.

Infra-red heating panel emits intense heat from heavy-gage bare wire.—Syntron Co, 205 Lexington Ave, Homer City, Pa.

Winter liner fits inside safety helmet, protects ears and neck from elements.—Industrial Products Co, 2808 North 4th St, Philadelphia 33, Pa.

Portable winch can lift 6,000 lb, weighs only 35 lb itself. Hoist speed is 10 fpm at full load, faster with lighter loads.—All American Engineering Co, Box 2668, DuPont Airport, Wilmington 5, Del.

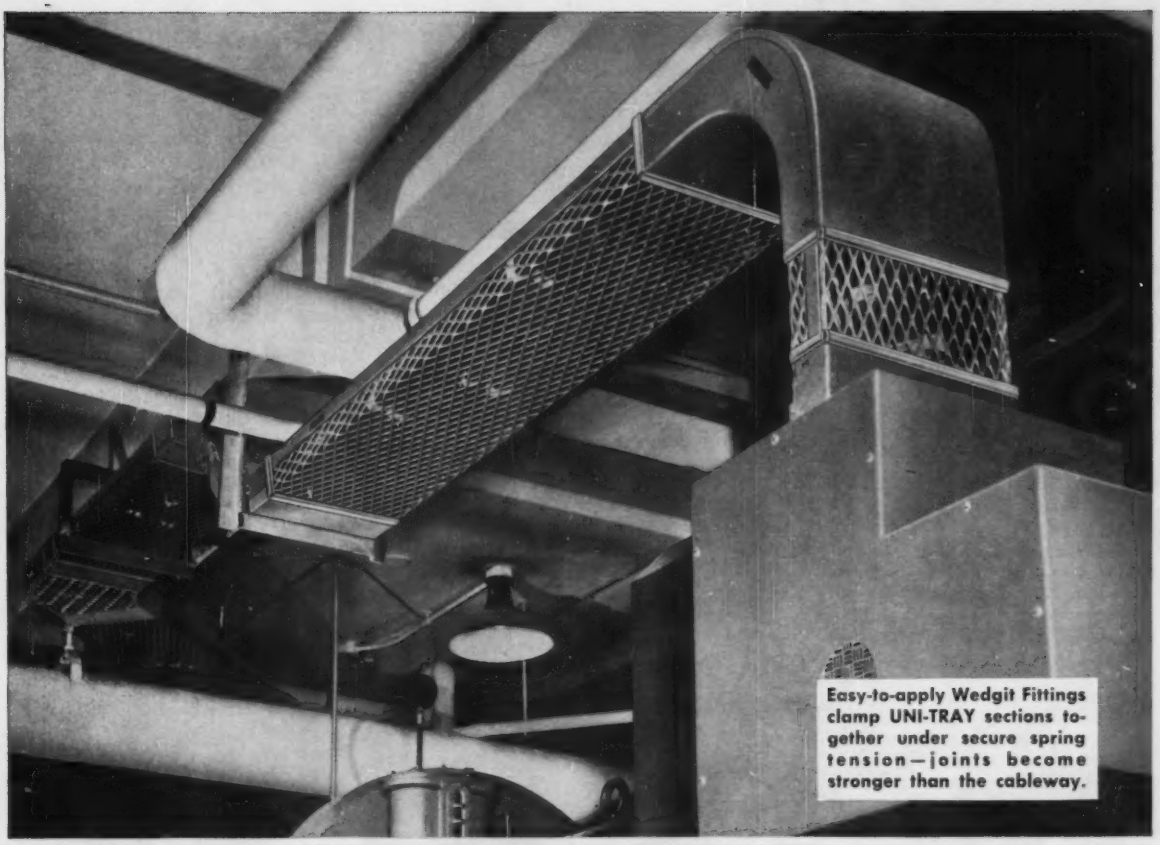
Electro-magnetic disc clutches for heavy duty have maximum torque of 120,000 ft-lb and 4,878 sq-in. of lining area. Operating mechanism can be removed without disturbing shafts. Ask for bulletin No. 501.—Stearns Electric Corp, 120 N. Broadway, Milwaukee 2, Wis.

Relay amplifier and spur-gear drive lengthen life of **contact devices** for V-60 polyphase meters.—General Electric Co, Meter Dept, Somersworth, N. H.

Motor-start capacitors have built-in bleeder resistor. They are compact and easily installed.—P. R. Mallory & Co Inc, Indianapolis, Ind.

Multi-range **crimper** for solderless terminals and connectors handles AWG range from 8 to 4/0 with self-contained rotating dies. A hand tool.—American Pamcor, Inc, 181 Hillcrest Ave, Havertown, Pa.

Mercury vapor lamps are coated to provide good color rendition in general lighting applications. Available in 400-, 700-, and 1,000-w sizes.—Westinghouse Electric Corp, Lamp Div, Bloomfield, N. J.



Easy-to-apply Wedgit Fittings clamp UNI-TRAY sections together under secure spring tension—joints become stronger than the cableway.

Lower installation costs with an improved

UNI-TRAY Cable-way System

With Delta-Star's UNI-TRAY Cable-ways you reduce installation time up to 40%—substantially cutting cableway costs. Simply position the trays, then tap in Wedgit Fittings to connect sections. No bolts, pins or hinges to fit or tighten. UNI-TRAY Cable-way joints are assembled four times faster than with other type fittings.

Strong, lightweight expanded metal sections provide ventilation necessary for high current rating of cables—prevent collection of water and dirt. Continuous Wedgit contact areas provide excellent electrical contact for ground currents.

UNI-TRAY sections are available in hot-dip galvanized steel, with aluminum Wedgit fittings. Aluminum sections also available. A wide variety of shapes and sizes meet specific requirements.

For complete facts, write for UNI-TRAY Publication No. 68—or see your nearby Delta-Star representative. *Delta-Star Electric Division, H. K. Porter Company, Inc., 2437 Fulton Street, Chicago 12, Illinois. District offices in principal cities.*

H. K. PORTER COMPANY, INC.

DELTA-STAR ELECTRIC DIVISION

Porter Divisions: Cleveland, Connors Steel, Delta-Star Electric, Henry Disston, Leschen Wire Rope, Quaker Rubber, Refractories, Riverside-Alloy Metal, Vulcan Crucible Steel, W-S Fittings, H. K. Porter Company (Canada) Ltd.

What Makes RT&E Transformers Better?

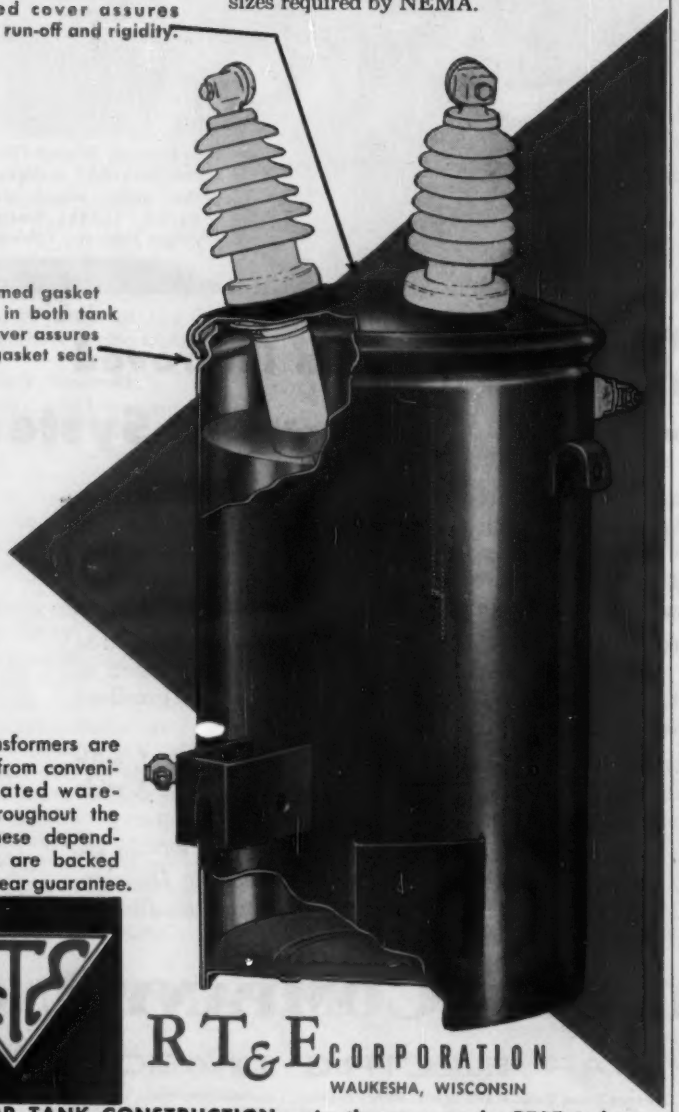
SUPERIOR TANK CONSTRUCTION
for longer Trouble-free life

RT&E tanks get three coats of modified alkyd paint — two coats flowed on, final coat sprayed — and each coat individually baked. This thoroughness provides the highest type of weather resistance. Arc welding of all seams, brackets and mounting pads, eliminates moisture traps and corrosion.

These heavy gauge steel tanks, with circular grooved bottoms, assure extra strength. Tin plated, locked type terminals accommodate either copper or aluminum conductor in the full range at sizes required by NEMA.

Domed cover assures water run-off and rigidity.

Preformed gasket surfaces in both tank and cover assures tight gasket seal.



RT&E Transformers are available from conveniently located warehouses throughout the nation. These dependable units are backed by a five year guarantee.

RT&E CORPORATION
WAUKESHA, WISCONSIN

SUPERIOR TANK CONSTRUCTION — *Another reason why* RT&E *is better.*

CATALOGS–BULLETINS

For copies of literature listed, write Electrical World, 330 W. 42nd St, New York 36, N. Y. Refer to key number following description.

• **OIL CIRCUIT RECLOSERS:** Line Material Industries has published three bulletins.

Application of Automatic Oil Circuit Reclosers (56107) 8 pp. (EW-1210)

A New Increased Capacity High-Speed Three-Phase Oil Circuit Recloser (56028) 12 pp. (EW-1211)

Coordinated Protection of Distribution Circuits (57004) 18 pp. (EW-1212)

• **LIQUID METAL SYSTEMS:** General Electric Co has published six bulletins on components for liquid metal systems.

Magnetic Flowmeter (GEA-6360A) 4 pp. (EW-1213)

A-c Electromagnetic Pump (GEA-6395A) 4 pp. (EW-1214)

Sodium Oxide Control Station (GEA 6453A) 4 pp. (EW-1215)

Liquid Level Indicator (GEA-6454A) 2 pp. (EW-1216)

Cold Trap (GEA-6456A) 2 pp. (EW-1217)

Plugging Indicator (GEA-6457A) 2 pp. (EW-1218)

• **CRANE-EXCAVATOR:** A 4-p bulletin from Schield Bantam Co describes the self-propelled Model CR-35 crane-excavator rated at 7 tons. Specifications are included. (EW-1219)

• **MODULAR TROFFERS:** An 8-p bulletin covers Pittsburgh Reflector Co's line of recessed modular fluorescent troffers. (EW-1220)

• **NUCLEAR ENGINEERS:** "ASTRA" (Advanced Scientific Techniques Research Associates) explains its services in nuclear technology, research & development, and physics engineering with a 28-p brochure. (EW-1221)

• **CABLE-OIL PURIFIER:** A 4-p bulletin describes Commercial Filters Corp's installation which purifies oil in 138-kv pipe cables at Commonwealth Edison Co. (EW-1222)

• **FLUORESCENT FLOODLIGHTS:** Revere Electric Mfg Co has published a 4-p bulletin on its high-mounting floodlights for service stations. (EW-1223)

• **AIR CONDITIONERS:** Remote packaged air conditioners (15-, 20-, and 25-ton) for industrial applications are described in a 4-p bulletin from Worthington Corp. (EW-1224)

• **SLIMICIDE:** United Chemical Corp of New England offers a technical bulletin on "El-Tox", a product to destroy slime in cooling towers. (EW-1225)

Tough coverings on Anaconda Heavy Line Wire help solve your primary problem

ANACONDA Heavy Line Wire has been designed to solve your primary distribution problems—with today's higher voltages in mind.

It's made with a tough thermoplastic covering. This covering has high resistance to moisture, weathering and abrasion. It protects conductors from contact with wet and broken limbs—from damage caused by wind, rain, sleet and snow. There's greater freedom from faults, less pruning needed. You save money . . . improve public relations.

Covering consists either of rugged polyethylene or time-tested Anaconda Densheath* vinyl resin compound. Conductors are being supplied in copper, aluminum, and ACSR.

NEW BULLETIN DM-5705 contains full information, including sizes, diameters, etc., plus special sag and tension charts. See your distributor or the Man from Anaconda for free copy. Or write: Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y. *Reg. U. S. Pat. Off. 87418

LIVE BETTER ELECTRICALLY

SEE THE MAN FROM **ANACONDA®** FOR HEAVY LINE WIRE

MEETINGS CALENDAR

DECEMBER

Electronic Industries Association—Conference on Maintainability of Electronic Equipment, University of Southern California, Los Angeles, Calif., Dec. 18-19.

JANUARY

International Home Furnishings Market—Including Appliance Show, The Merchandise Mart, Chicago, Illinois, January 6-17.

Edison Electric Institute—Home Service Committee, Chicago, Ill., Jan. 8; 2nd Annual LBE National Women's Conference, Edgewater Beach Hotel, Chicago, Ill., Jan. 9-11; Industrial Relations Committee, Mayflower Hotel, Washington, D. C., Jan. 16-17; Dealer Coordination Committee, EEI Headquarters, New York City, Jan. 30-31.

Instrument Society of America—Boston Section, Yankee Instrument Fair & Symposium, Hotel Bradford, Boston, Mass., Jan. 14-15.

• **Southeastern Electric Exchange**—Personnel Administration Section, Biltmore Hotel, Atlanta, Ga., Jan. 16-17.

• **New England Farm Electrification Institute**—University of Massachusetts, Amherst, Mass., Jan. 22-24.

Industrial Heating Equipment Association — Penn Sheraton Hotel, Pittsburgh, Pa., Jan. 27-28.

American Society of Heating and Air-Conditioning Engineers—64th Annual Meeting, Penn-Sheraton Hotel, Pittsburgh, Pa., Jan. 27-29.

Home Improvement Products Show—Hotel Sherman, Chicago, Ill., Jan. 27-29.

• **Annual Doble Engineering Clients Conference**—Sheraton-Plaza Hotel, Boston, Mass., Jan. 27-31.

FEBRUARY

National Association of Purchasing Agents—Public Utility Buyers Group Mid-Winter Meeting, Sheraton Hotel, Philadelphia, Pa., Feb. 2-4.

National Rural Electric Cooperative Association—Annual Meeting, Memorial Auditorium, Dallas, Tex., Feb. 2-6.

Edison Electric Institute — Prime Movers Committee, Penn Sheraton Hotel, Pittsburgh, Pa., Feb. 3-5; Industrial Power & Heating Group, Netherland Hilton Hotel, Cincinnati, Ohio, Feb. 6-7; EEI-AGA 1958 Conference Final Planning Meetings, Ben Franklin Hotel, Philadelphia, Pa., Feb. 6-7; Electrical Equipment Committee, Dayton Biltmore Hotel, Dayton, Ohio, Feb. 10-11; Transmission & Distribution Committee, Lord Baltimore Hotel, Baltimore, Md., Feb. 11-12; Meter & Service Committee, Sheraton Hotel, Philadelphia, Pa., Feb. 17-19.

Industrial Electrification Council—National Industrial Heating Conference, Netherlands Hilton Hotel, Cincinnati, Ohio, Feb. 3-6.

American Institute of Electrical Engineers—Winter General Meeting, Statler and Sheraton-McAlpin Hotel, New York City, Feb. 3-7.

Missouri Valley Electric Association—Industrial & Commercial Sales Conference, President Hotel, Kansas City, Missouri, Feb. 6-7.

NATIONAL ELECTRICAL WEEK WILL BE OBSERVED FEBRUARY 9-15.

American Public Power Association—Engineering & Workshop Meetings, Chattanooga, Tenn., Feb., 13-14.

National Society of Professional Engineers—Spring Meeting, Michigan State University, East Lansing, Mich., Feb. 13-15.

American Institute of Mining, Metallurgical, and Petroleum Engineers—Annual Meeting, Hotel Statler, New York City, Feb. 16-20.

• **National Wiring Sales Conference**—Statler Hotel, Detroit, Mich., Feb. 20-21.

• **Pennsylvania Electric Association** — Electrical Equipment Committee Winter Meeting, Hotel Roosevelt, Pittsburgh, Pa., Feb. 27-28.

MARCH

Southern Safety Conference, Inc—Exposition, Peabody Hotel, Memphis, Tenn., March 2-4.

Lighting Lamps and Electrical Manufacturers Salesmen's Association—First National Lighting Exposition, Coliseum, New York City, March 9-12.

Nuclear Congress—Co-sponsored by American Society of Mechanical Engineers and the Engineers Joint Council, International Amphitheater, Chicago, Ill., March 16-22.

National Association of Corrosion Engineers—Annual Conference & Exhibition, Municipal Auditorium, San Francisco, Calif., March 17-21.

American Society of Mechanical Engineers—Management Conference Committee, Hotel Somerset, Boston, Mass., March 19-20.

Edison Electric Institute—Industrial Relations Committee, Headquarters, New York City, March 20; Annual Sales Conference, Edgewater Beach Hotel, Chicago, Ill., March 24-27.

• **Institute of Radio Engineers**—National convention, Waldorf-Astoria Hotel and New York Coliseum, New York City, March 24-27.

American Power Conference—20th Anniversary Meeting, Sherman Hotel, Chicago, Ill., March 26-28.

Southeastern Electric Exchange—Annual Meeting, Boca Raton Hotel and Club, Boca Raton, Fla., March 31-April 2.

• Additions this week.

MORE BIG DATES FOR '58

American Public Power Association—Annual Meeting, New Orleans, May 6-8.

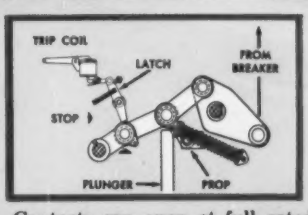
National Association of Purchasing Agents—Annual Convention, Chicago, May 11-14.

Edison Electric Institute—26th Annual Convention, Boston, June 9-12.

American Institute of Electrical Engineers—Summer General Meeting, Buffalo, June 22-27.

National Electrical Manufacturers Association—Annual Meeting, Atlantic City, Nov. 10-14.

For positive protection this Pneu-Draulic operated breaker is mechanically trip-free



This simple uncoupling linkage is key to protection

Contacts can open at full rated speed with the Allis-Chalmers mechanically trip-free mechanism regardless of position of closing mechanism.

Breakers that are only pneumatically or hydraulically trip-free can't give you this protection.

Pneu-Draulic is an Allis-Chalmers trademark.

Get details on this and other features of Allis-Chalmers breakers. Call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

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Allis-Chalmers unit substations limit today's costs to today's loads

HERE'S an outstanding new installation in the Middle West — a neat, compact, well built Allis-Chalmers substation — with a modern brick wall for good landscaping.

The initial investment for a 10,000-kva unit substation meets today's needs, and it's arranged to add another 10,000 kva with space available clear to the lot line.

And it's easy, with Allis-Chalmers completely factory-built and tested units, to add feeders, or another (or larger) transformer at any time — only space requirements need be preplanned by the utility.

A-534

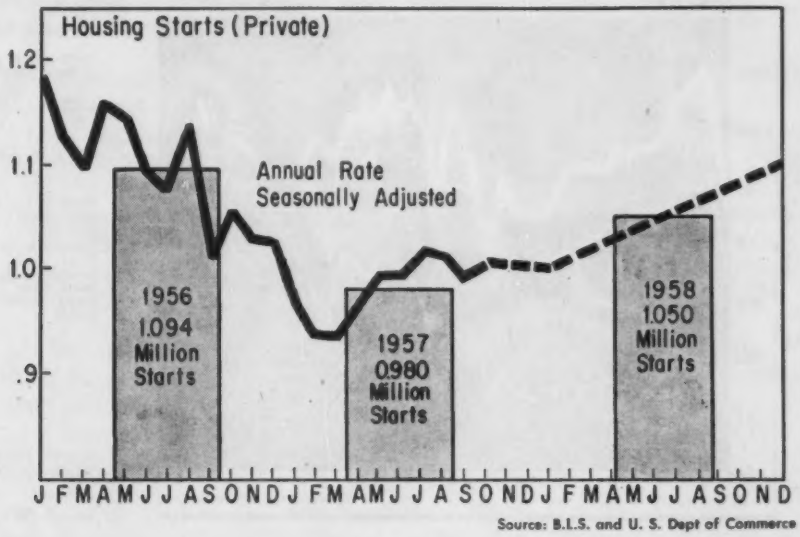
Ask for Bulletin 1187912

For power where you need it, when you need it, for easy, time-saving installation, call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS *for progress in switchgear*

ELECTRICAL BUSINESS OUTLOOK

Electrical World
DECEMBER 16, 1957



Source: B.L.S. and U. S. Dept of Commerce

Housing Will Bolster '58 Building

Spending for all types of construction will hit $49.6 billion in 1958, according to the joint estimate by U. S. Commerce and Labor Depts. That would represent a gain of 5%—with about 3% coming from higher building costs. And it would better the '57 record which was off 2% in real terms, mainly because of the lag in residential construction.

Private housing will rebound to 1,050,000 starts next year, if the government forecast is correct. This year the number of units slumped to 980,000 for the first year to wind up under 1 million since 1948. Right now homebuilding still suffers from a hangover of tight money and high costs that have many builders holding back on plans for '58. But the Fed's recent steps to ease credit will help.

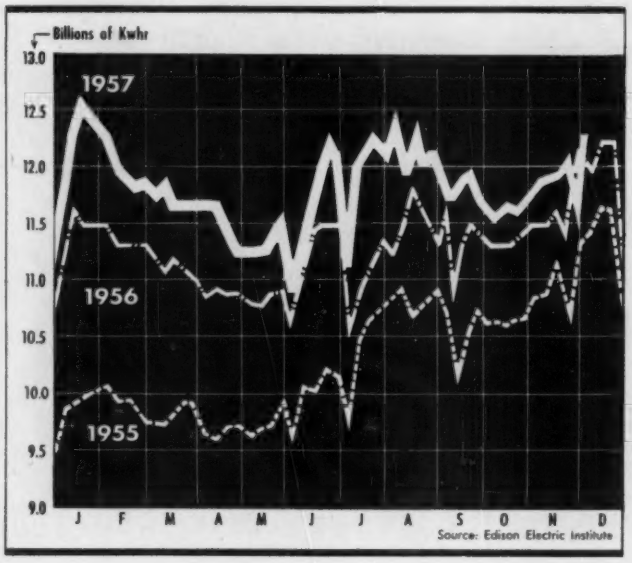
Industrial plant expansion will drop off by a sizeable 9% from the '57 level, as most companies and industries trim back their capital spending (EW, Nov. 11, 1957). But utilities will spend $2.35 billion (up 12%) on new plant in '58.

Public construction should just about match this year's 8% spurt. Easier credit will do a lot to shift resources from industrial construction into municipal projects (such as schools, hospitals, etc.) which have been held up on financing. But almost two-thirds of the $1 billion increase in public spending ties into the Federal Highway Program which should move into higher gear in '58. Total road-building will mount to about $5.5 billion next year.

The pluses just about offset the minuses in other construction. Military projects will be down 11%. Farm construction will hold even. But the "commercial" sector—stores, office buildings, warehouses—will show a 5% gain.

Add it all up and you get a good construction year for '58. It will be a record as far as dollars go—and just a shade under 1955's boom in real terms. As far as utilities are concerned, the important trend is the shift from industrial expansion to residential and commercial building.

STATISTICS



OUTPUT

Week ended December 7,
12,315,000,000 Kwhr
Up 2.2%

Per Cent Change From Previous Year

	Nov. 23	Nov. 30	Dec. 7
Total U. S.	+ 6.1	−3.8	+2.2
New Eng.	+ 6.7	−6.6	+2.9
Mid. Atlan.	+ 6.2	−4.6	+2.3
Cent. Ind.	+ 6.2	−7.2	+0.1
West Cent.	+ 9.3	−2.5	+1.6
Southeast	+ 3.7	−3.8	+4.8
South Cent.	+ 8.2	+4.7	+4.2
Rocky Mount.	+ 5.1	+1.8	+2.1
Pacific			
NW	+ 3.4	−1.9	−2.5
SW	+10.8	−2.0	+4.7

Seasonally Adjusted Index 227.6
Week Ago 226.8
Year Ago 222.2

Atomic Energy Commission requirements—1,050,000,000 Kwhr (Electrical World estimate). Excluding AEC, output increase was 3.1%

Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity	Sept.	126.24	125.75	118.66	6.4
Peak—Class 1 Systems (million kw)	June	104.6	97.8	97.2	7.6
Estimated Dec. '57 Peak (million kw)	Aug.	113.0	113.2	114.6	−1.4
Production—billion kwhr	Sept.	51.57	55.45	48.82	5.6
Hydro		9.28	10.03	8.96	3.6
Fuel		42.29	45.42	39.86	6.1
Sales—billion kwhr	Aug.	49.79	48.09	46.24	7.7
Residential		13.05	12.59	11.60	12.5
Commercial		8.76	8.54	7.94	10.3
Industrial		25.06	24.07	23.93	4.7
Other		2.93	2.88	2.77	5.8
Fuel Consumption	Sept.				
Coal—million tons		12.75	13.33	12.45	2.4
Oil—million barrels		5.64	5.79	5.20	8.5
Gas—billion cu ft		137.60	160.96	124.63	10.4
Net Income Class A & B Co's $—million	Sept.	116.13	108.86	108.33	7.2
Residential Customers—millions	12 mos	46.61	46.49	45.39	2.7
Revenue per kwhr	ended	2.57¢	2.57¢	2.61¢	−1.5
Avg kwhr per customer	Sept. 30	3,121	3,104	2,929	6.6
Avg annual bill		$80.21	$79.77	$76.45	4.9

Business Statistics . . .

Indexes: 1947–49 = 100					
FRB Industrial Production	Oct.	147	145	151	−2.6
ENR Construction Cost	Dec.	154.7	154.6	147.6	4.8
BLS Cost-of-living	Oct.	121.1	121.1	117.7	2.9
New Orders for Machinery (1950 = 100)	Sept.	141	136	136	3.7
NEMA Sales					
Insulation materials	Sept.	135	134	141	−4.3
Electric appliances		97	86	101	−4.0
Wholesale prices	Oct.				
Motors and generators		143.0	143.3	136.9	4.5
Transformers and regulators		150.8	150.8	144.8	4.1
Switchgear and fuses		170.9	170.6	161.9	5.6
GNP—annual rate—$ billion	3rd qtr.	439.0	434.3	416.7	5.4

MANAGEMENT BULLETIN

FINANCE ▶ **New security offerings of electric utility companies now scheduled** for January total over $200 million. It is mostly in first mortgage bonds.

Institutions are now looking at electric utility common stocks. The ones they are favoring are: American Gas & Electric Co, Florida Power Corp, Florida Power & Light Co, Central & South West Corp, Oklahoma Gas & Electric Co, Tampa Electric Co, and Texas Utilities.

These companies are expected to increase their dividends in 1958: Commonwealth Edison Co, El Paso Electric Co, General Public Utilities, Louisville Gas & Electric Co, Middle South Utilities, Public Service Co of Indiana, and Southern California Edison Co.

A "ready reference sheet" to money market interest rates has just been published by the Investment Administration Division of the Irving Trust Co. It shows current Federal Reserve Board discount rate, New York commercial bank lending rates, finance company paper, commercial paper, and bankers acceptances. For copy write John Childs, vp, Irving Trust Co, 1 Wall St, New York 15.

Quarterly common stock dividend increases. Kansas City Gas & Electric Co from 33¢ to 35¢; Atlantic City Electric from 32½¢ to 35¢, and Florida Power & Light Co from 32¢ to 35¢ a share.

RATES ▶ **These companies have received rate increases:** Louisville Gas & Electric Co which had put in a $3,699,237 a year rate increase ($2,168,631 electric and $1,530,606 gas), received Kentucky PSC approval to increase rates by $4,485,429 a year ($2,740,698 electric and $1,744,731 gas). Rate of return on the combined operations will be 6.28%, PSC officials say . . . Missouri Power & Light Co received PSC approval to increase electric rates by $664,270 a year.

Requests for rate hikes are increasing. New York State Electric & Gas asks PSC for a $4,225,000 a year rate increase to become effective on Feb. 1, 1958.

Massachusetts Department of Public Utilities is investigating the advisability of revising its order issued March 19,1946 establishing uniform general principles and terms relative to fuel clauses in rate schedules of electric companies, such revision to apply particularly to: (a) definition of fuels; (b) alongside cost; (c) base cost of fuels; (d) fuel adjustments to reflect efficiency; (e) inclusion and adjustment of fuel clause in contracts.

SOUTHWESTERN PS ▶ **Southwestern Public Service Co** will spend $80 million for new construction in the five-year period beginning in 1958. This forecast was made by Chairman H. L. Nichols (r) and Vice President Don D. Loden at a recent meeting of the New York Society of Security Analysts. To pay for this outlay, the company expects to float new securities totaling $51 million ($35 million in bonds, $7 million in preferred stock, and $9 million in common stock) with the balance coming from internal sources. No common stock will be sold until late in 1961 or early 1962. Company will first offer the common to its stockholders on a 1-for-20 basis. However, Nichols said, the company would be in the market to sell $16 million in bonds and preferred stock in March, 1959.

H. L. NICHOLS

Earnings are expected to increase from $1.93 a share in fiscal 1958 to around $2.80 a share by 1962. In fiscal 1957 they stood at $1.80. Company dividends

(based on a 75% payout) should hit around $2.10 a share in 1962 as compared with $1.48 a share annually at present.

SPS Co has a 5.75% rate of return now. It expects this to jump to 6.01% in 1958 and should hit 7% in the next three or four years. This is based on "fair value" of properties in New Mexico.

Company officials said that the next generating plant to come onto the lines would be in 1960. It will be a 112,500-kw station, costing some $15 million and will be built between Amarillo and Borger, Texas.

MAINE PS ▶

C. H. STETSON

Over 70% of the revenue of Maine Public Service Co comes from residential and commercial customers, Pres C. Hazen Stetson (r) told the New York Society of Security Analysts recently. Reason, he said, is that "we have no large industry, but scattered throughout are small factories and mills that provide the payrolls and process the raw products of the field and forest." Nearly 18% of the revenue, Stetson continued, comes from small electric utilities serving small sections of the surrounding area. These utilities derive about the same percentage of their revenues from residential and commercial customers as Maine PS does. This means, Stetson said, that only about 12% of revenues of the company come from industrial customers and military establishments.

Consolidated gross operating revenues have grown from $1,357,000 in 1946 to $4,467,357 for the 12 months ended October 31. Customers went from 16,893 in 1946 to 27,196 as of October 31. Of this number 21,646 are Maine customers and 5,550 Canadian.

Although the average use per residential customer is below the national average at the present time (having jumped from 893 kwhr in 1946 to 2,247 kwhr in 1957), Stetson said company is putting on a "revitalized merchandising program" that he hopes will be able to close the gap. Program is designed to promote the sale of load-building appliances through its own merchandising outlets as well as through cooperative dealer programs.

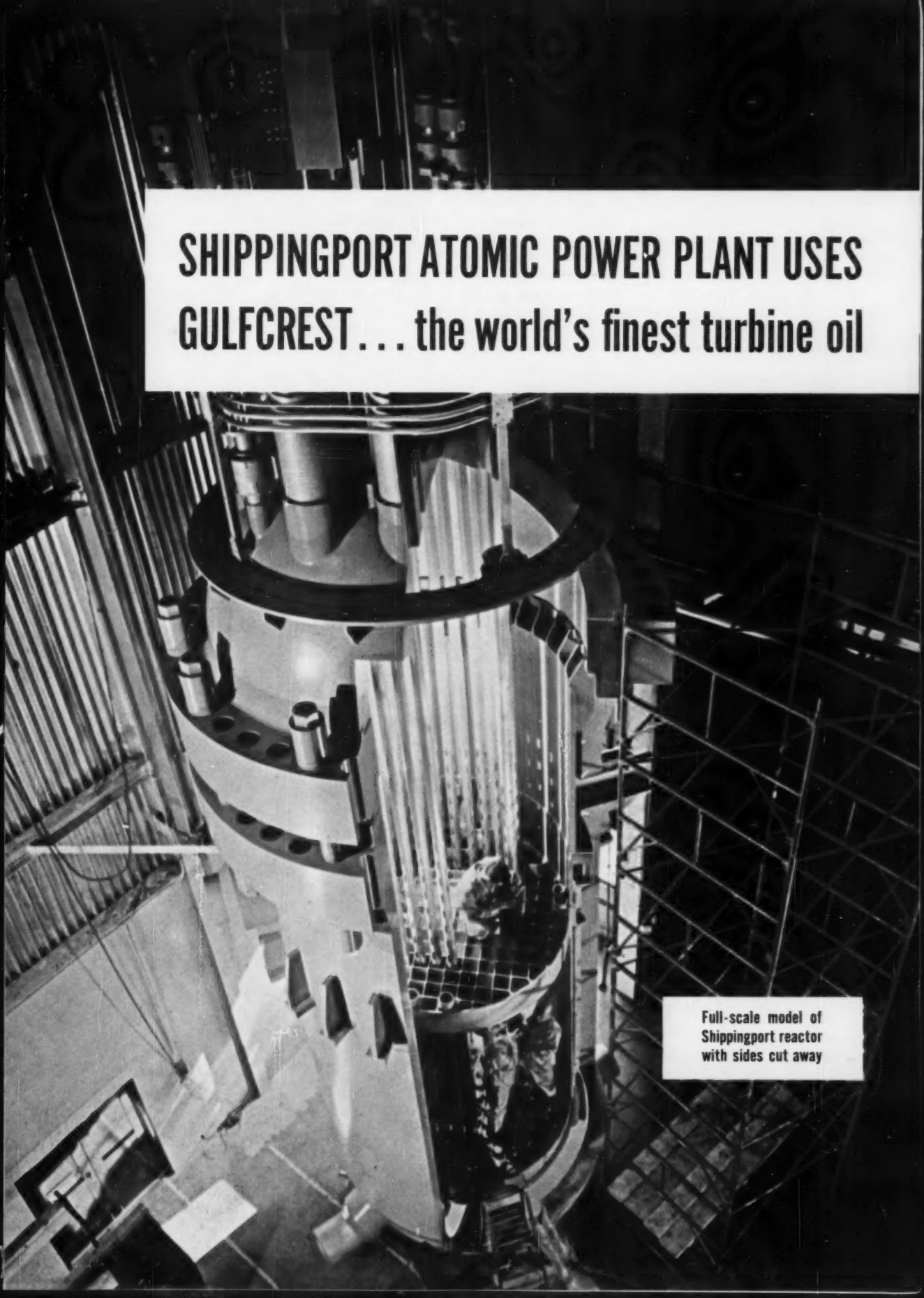
For income tax purposes the company is using accelerated depreciation of plant property and is normalizing tax accruals in the income statement in accordance with a Maine PUC order. The resulting credit is shown on the balance sheet at a special reserve. Similar treatment is accorded rapid amortization of defense facilities.

Company does not contemplate any rate increase at the present time. However, under the same formula used by the company in its 1956 rate case, the present rate of return is about 6.36%. If, Stetson said, we apply the Maine Supreme Court's decision in the recent Central Maine Power Co's case regarding the use of accelerated depreciation, rate of return would be increased by only 0.3%.

EMPLOYEE RELATIONS ▶

Here are the latest wage settlements. Mississippi Power & Light Co and IBEW agree to one-year contract for a 5.5% wage increase . . . Gulf States Utilities Co and its independent union complete negotiations for a two-year contract with a one-year wage re-opening clause. Wages will be increased by 5.5% with a minimum of 10¢ an hour, making an average of 5.74% . . . California Electric Power Co and IBEW reach 18-month contract. It calls for an improvement factor wage raise of 4¢ an hour, an automatic cost-of-living increase of 1¢ an hour each quarter, and another 1¢ an hour based on the cost-of-living index.

SHIPPINGPORT ATOMIC POWER PLANT USES GULFCREST . . . the world's finest turbine oil



Full-scale model of Shippingport reactor with sides cut away

Giant step toward abundant atomic power for all America!

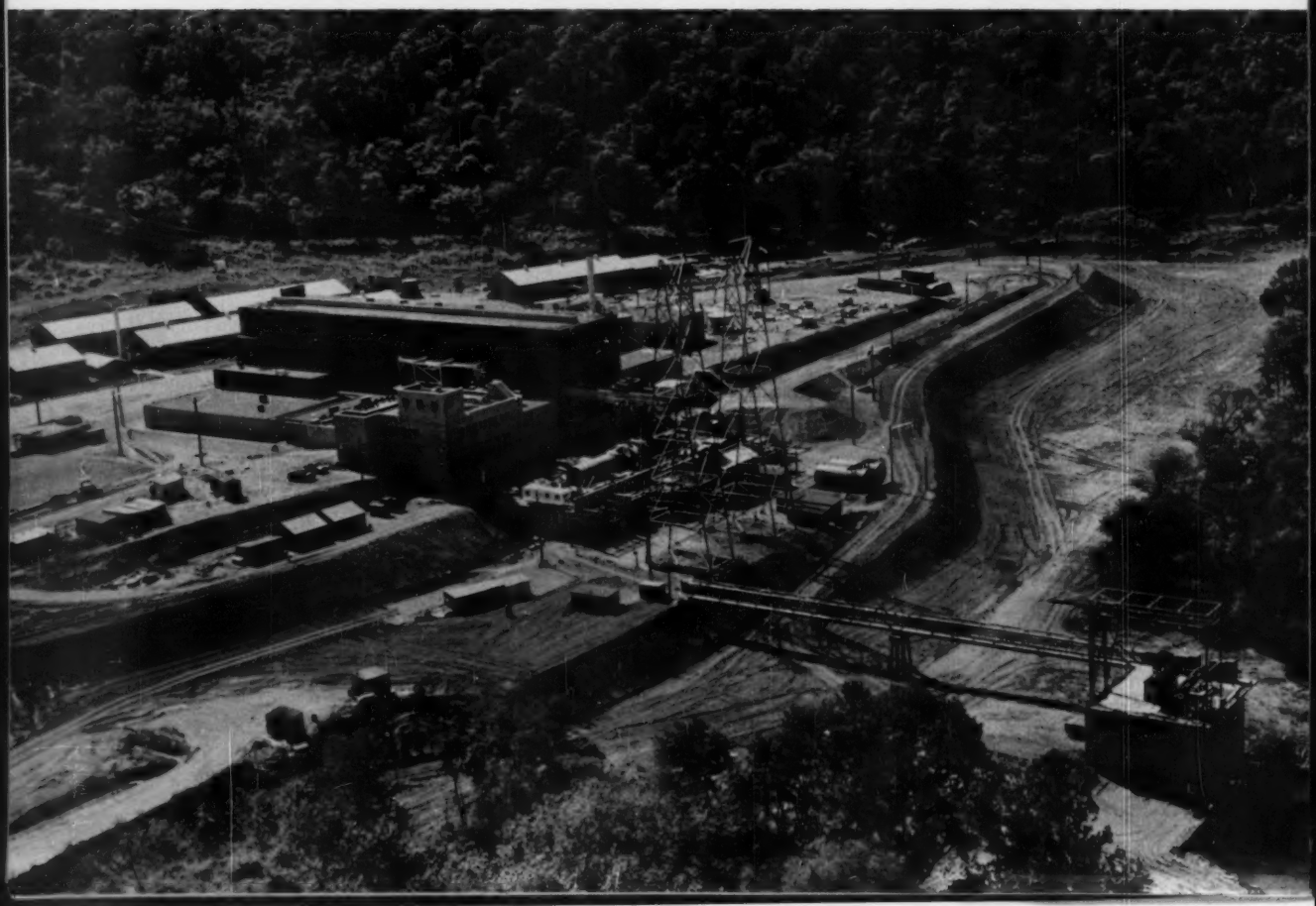
They're splitting atoms down on the Ohio, at Shippingport, Pennsylvania—and any day now electric power from nuclear fission will provide additional power and light for the Pittsburgh area.

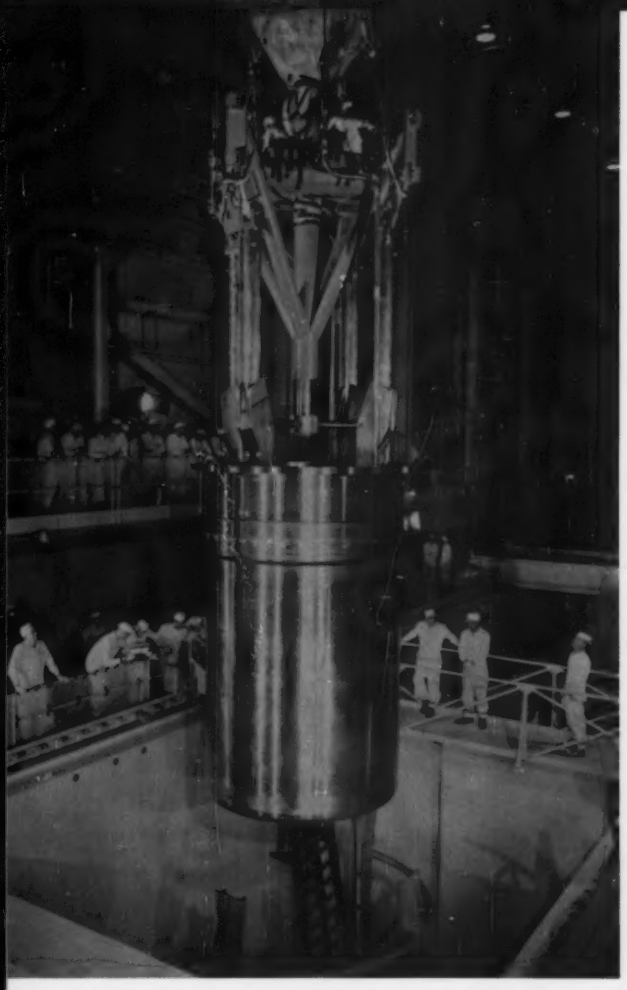
Shippingport is America's first full-scale atomic power plant for generating peacetime power—a joint venture of the U. S. Atomic Energy Commission and Duquesne Light Company. Westinghouse Electric Corporation designed and developed the nuclear components under contract with the Atomic Energy Commission.

The plant is powered by a pressurized water reactor. Fuel elements—a combination of 14 tons of natural uranium and 165 pounds of highly enriched uranium—form the "heart" of the reactor. Sheathed inside a steel pressure vessel, the reactor acts as a furnace, in which uranium atoms are split to produce heat. Water heated by this nuclear fission is pumped to heat exchangers, to make steam to spin the turbine. And the turbine-generator is lubricated by GULFCREST . . . the world's finest turbine oil.

A new source of energy is being harnessed at Shippingport!

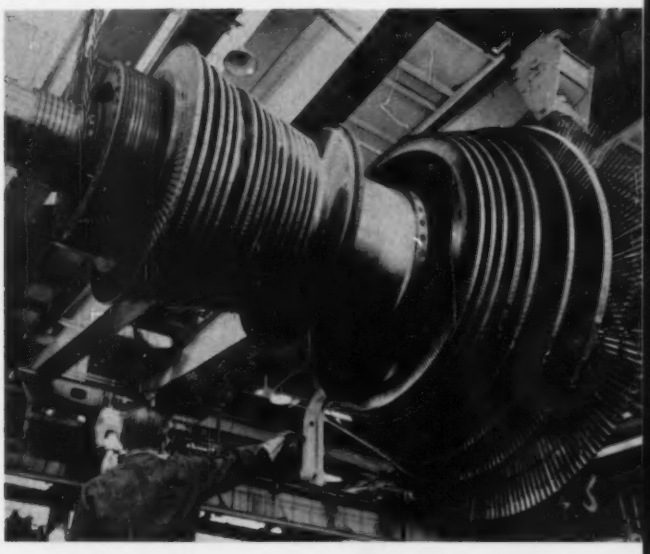
Experience gained here in nuclear power plant construction and operation will provide a firm basis for projecting the future of nuclear power generation. Gulf is proud that Gulfcrest turbine oil and Gulf service are playing a vital role at Shippingport—America's first full-scale atomic power plant.





Reactor core being lowered into place on October 6, 1957

Rotor for 100,000 kw Shippingport turbine



Reactor and heat exchangers go underground... the turbine-generator operates outside

A self-sustaining chain reaction of nuclear fission takes place when control rods are withdrawn from the "heart." Rods are made of hafnium metal, which can absorb neutrons and retard the heat-producing process. Inserting the rods reduces the number of atoms being split—withdrawing them increases the number.

Walls of the pressure vessel holding the nuclear reactor are 8" thick—of carbon steel, with ¼" stainless steel cladding. The reactor is inherently stable, with a built-in safety factor: "negative temperature coefficient." As reactor temperature increases, fissioning decreases.

Circulating water is heated by fission, under pressure to prevent boiling . . . goes to underground heat exchangers, makes the steam which drives the giant turbine-generator unit.

Built by Westinghouse for Duquesne Light Company, the unit will operate in the open, without walls or roof—the first such installation in this part of the country.

The complete turbine unit weighs 1,300,000 pounds, is 81 feet long, can handle over 1,400,000 pounds of steam per hour. It is designed to deliver 100,000 kw.

Gulfcrest was chosen as the ideal turbine oil for this power plant because of its past performance record in the electric utility field.

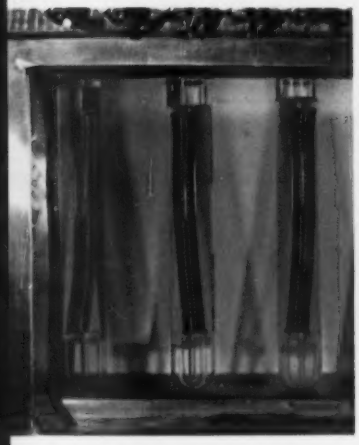
GULF

WHY GULFCREST GIVES UNMATCHED PERFORMANCE AND TURBINE PROTECTION...

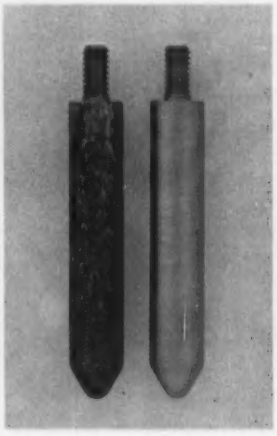
In Gulf's marketing area, more power is generated by central station steam turbines lubricated with Gulfcrest than with any other turbine oil . . . Here's why:

No other turbine lubricant offers the same oxidation resistance, corrosion protection, or anti-foam and anti-wear properties. Gulfcrest is ALCHOR-PROCESSED . . . an *extra* step in refining which eliminates more unstable hydrocarbons remaining after normal refining. Super-refined Gulfcrest performs every vital function of a turbine oil *better*—reducing friction, dissipating heat, minimizing the effects of air entrainment. Gulfcrest keeps turbine systems clean longer . . . has performed for as long as 20 years in some large turbines* without any significant rise in neutralization numbers . . . has provided safe, sure turbine protection for leading utilities for many years.

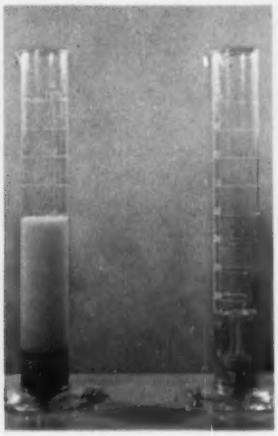
*Names on request



Here, iron and copper coils are immersed in oil heated to 203°F . . . oxygen is bubbled through in the presence of water.



Oil, water heated to 140°F. Polished carbon steel rod is immersed, rotated for 24 hours. Rod protected by Gulfcrest stays bright.



Air is blown into both oil samples. Gulfcrest stays free of foam!

Lab tests prove that Gulfcrest gives extra protection under boundary lubrication conditions.

GULFCREST has superior stability

Gulfcrest retains its golden color, even after many hours under this ASTM Test D-943-54! (Change of color would indicate hydrocarbon or additive deterioration.)

GULFCREST prevents corrosion

Gulfcrest contains "quick platers" for immediate protection, "slow platers" for reserve protection. Note how ASTM Test D-665-54 proves Gulfcrest's extra corrosion resistance!

GULFCREST prevents foaming

Gulfcrest is inhibited by a most effective silicone additive. There will be no foaming in the Shippingport turbine lubricating system.

GULFCREST, ideal for emergency conditions

Gulfcrest has superior anti-wear properties, as proved by this 4-ball wear tester. A special additive imparts these characteristics, which provide extra protection during critical operating periods.

GULF OIL CORPORATION
Department DM, Gulf Building, Pittsburgh 30, Pa.

Please send me the free booklet on Gulfcrest.

Name_____

Title_____

Company_____

Address_____

City_____ Zone____ State_____

Ask your Gulf man about Gulfcrest for your turbines . . . and mail this coupon for your free fact-filled booklet, in color, about Gulfcrest.

GULF

SP-9180

Murray Mfg Will Market Manual Meter By-Pass

A manual-operated meter by-pass which will help reduce utility meter maintenance costs is ready for marketing by Murray Manufacturing Co, Brooklyn, N. Y. It is a shunting device which permits meter changing with uninterrupted service for customers.

This device is designed to be operated with only the aid of a screwdriver. It reportedly fits in standard multiple unit troughs and is interchangeable with interiors of other devices.

The by-pass is located in the mounting box and directly behind the meter. It has a pulldown tab with a hooked lip which is engaged by the sealing ring. The device cannot be operated without first removing the seal and meter ring. By this arrangment unauthorized current diversion is thus made impossible.

B&W to Build Variable Pressure Boiler for So Cal Edison

Babcock & Wilcox Co has been awarded a contract by Southern California Edison Co to build a "once-through" type of steam generator designed for operation with variable pressure for subcritical steam conditions.

Under terms of the contract, B&W will provide the steam generator—known as a "Universal Pressure" unit—for the utility's new station at Huntington Beach, Calif. The unit will provide steam at the rate of 1,638,000 lb per hr to the throttle of a 200,000-kw turbine at a pressure of 2,400 psi and a temperature of 1,050/1,000F. Completion of the unit, which will burn either natural gas or oil, is scheduled for March, 1960.

The universal pressure boiler permits control of the turbine output by varying boiler steam pressure instead of throttling the pressure at the turbine. This leads to a "considerable" saving in heat, according to Babcock & Wilcox officials. For this reason, they said, the development is expected to be of high interest in the utility field, because it comes at a time when electrical producers are making a concerted attempt to minimize the effect of inflation on the cost of power.

In addition to its heat-conservation advantages, the steam generator is expected to save utility companies money by obviating many components ordinarily required by conventional "drum-type" boilers of similar capacities, B&W sources said. Because it is more compact, weighs less, and is lower in height, it is expected that the unit will yield savings in power station construction, and that its simpler operation will make it cheaper to maintain.

The new Southern California Edison steam generator represents the extension to a broader field of application the gains realized from the nation's first commercial-scale universal pressure unit, noted a B&W source. Placed in operation at the Ohio Power Co's Philo, Ohio, plant early in 1957, this unit, also built by B&W, differs greatly from conventional steam generators with respect to principles of operation as well as design. It is the first of three universal pressure type units B&W has sold for the American Gas & Electric System.

Wire "Multiple-itis" Is Hit At Wires & Cable Meeting

Wire and cable manufacturers should quit making their old types of wire when they develop more efficient types to replace them.

George Albiez, president of the National Association of Electrical Distributors, offered this suggestion at the recent annual meeting of the Wire & Cable Section of the National Association of Electrical Manufacturers.

Albiez called for a set of wire and cable standards with the provision that "no new grade be introduced without dropping some existing grade from the line." He also called for "bold thinking" by manufacturers to solve sales and distribution problems, taking as his target multiplicity of sales and payment terms, warehouses and sales pricing structures.

(*More M & M on page* 162)

Federal Pacific Electric to Acquire Roller-Smith

Federal Pacific Electric Co, Newark, N. J., has completed negotiations to acquire the Roller-Smith Corp, Bethlehem, Pa., as a wholly owned subsidiary, according to T. M. Cole, Federal's executive vice president.

Cole announced the acquisition at the company's recent annual meeting. He said the company would exchange 25,000 shares of Federal's common stock for all of Roller-Smith's outstanding stock which amounts to 1,000 common shares and 2,480 preferred shares. Federal's common stock closed at $22 on Dec. 2 on the New York Stock Exchange.

Roller-Smith markets a line of precision electrical instruments, relays, air and oil circuit breakers, instrument transformers, and switchboard rotary switches. Cole noted that Roller-Smith's high power test laboratory at Northampton, Pa., will be immediately useful in current engineering and development projects.

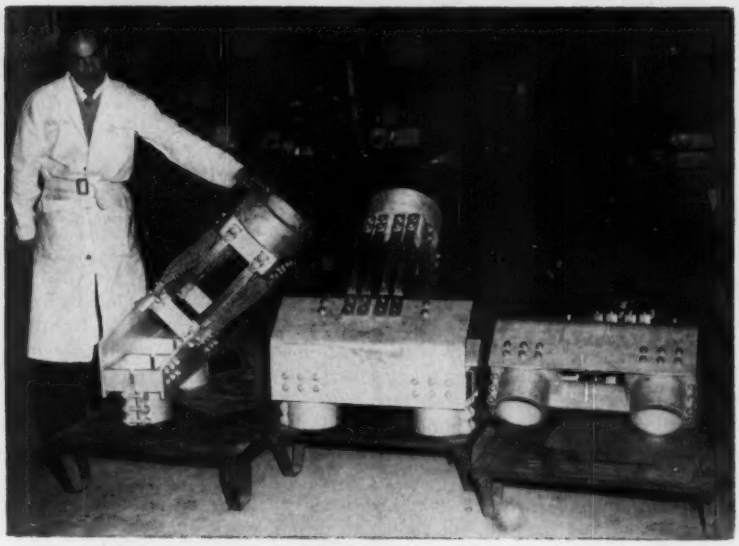
Federal Pacific manufactures molded case breakers, panelboards and switchboards, motor control centers, bus ducts, distribution transformers, and high voltage breakers.

Federal reported earnings of $716,144 on sales of $12,146,760 for the quarter ended Sept. 30, 1957. For the fiscal year ending June 30, 1957, net sales amounted to a record $49,558,232, an increase of 26% over 1956; profits rose to $2,464,932, another record high and a 37% increase over the previous year; earnings per common share were $2.57; and dividends per share totaled $0.80, plus 5% stock dividend on common stock. For 1956 the amounts were—net sales $39,256,528, earnings $2.13, and dividend $0.60.

Shareholders this year reportedly increased to about 7,700 from some 5,500 in 1956.

In looking ahead for the coming fiscal year, the expectations are that the general level of the company's business will improve over the record levels attained during the past two years. Cole said that among the factors contributing to the increase will be improved Distributor Products Division activities, resulting largely from a forecast rise in home building in 1958 compared to 1957. Profit margins and shipments at the Eastern Switchgear Division is expected to be most favorable. At Pacific Switchgear Division the backlog is sufficient to keep operating at full capacity for the fiscal year ending in 1958.

It's fourteenth plant will be opened in Atlanta in early 1958.



Savings Made in Large Terminals

These light-weight transformer-terminal connectors slash metal, shipping, and installation costs. Each weighs about 360 lb—a 100-lb saving. Burndy Corp (Norwalk, Conn.) built them for Texas Power & Light Co's new Stryker Creek steam electric generating station.

Weight savings spring from using bent copper plates instead of conventional castings.

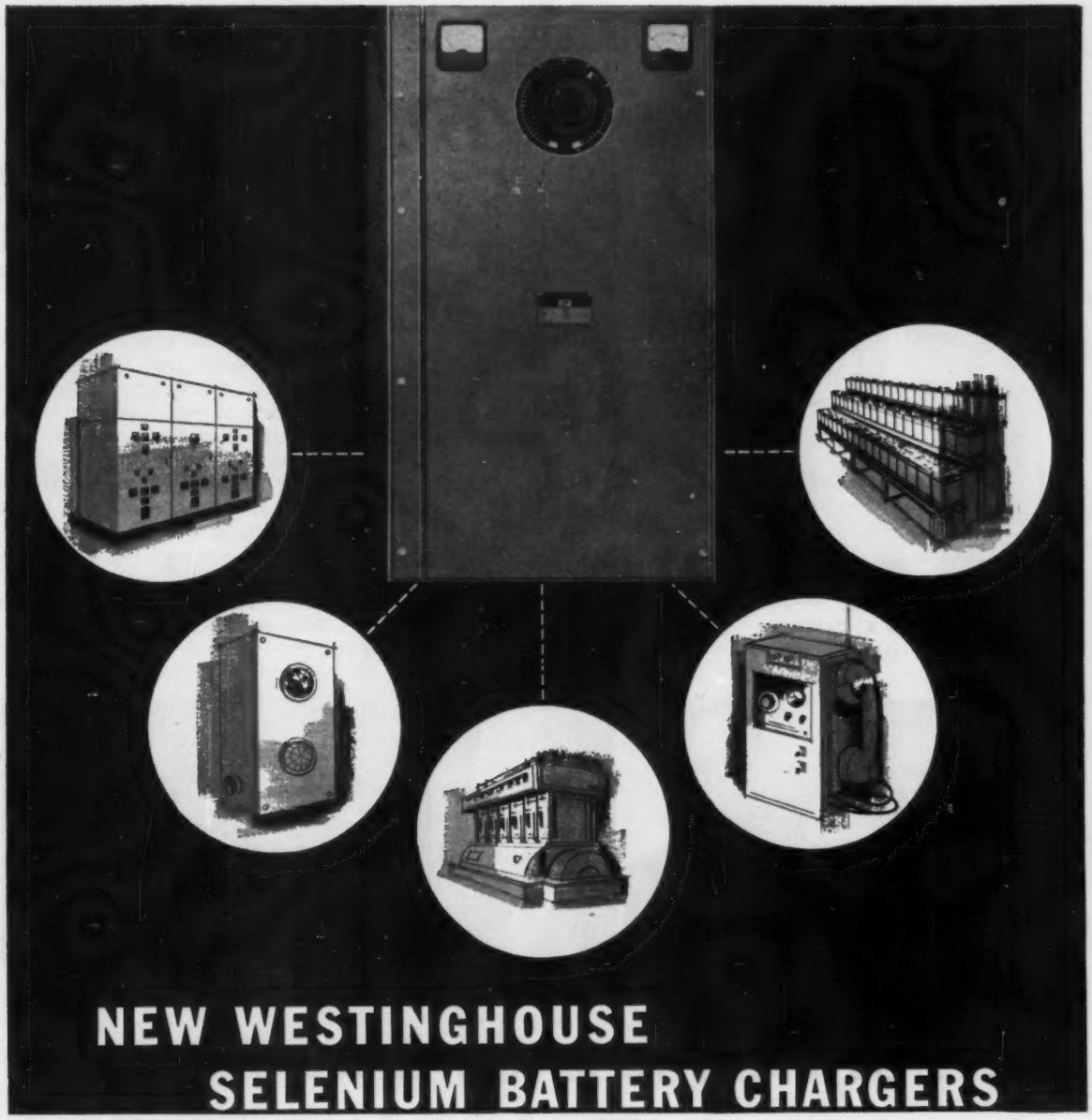
The connectors join the 12¾-in. o.d. aluminum generator buses to copper studs of the 200 Mva, 13.8-kv primary transformer windings. Each phase winding terminates in individual studs, so each connector links a pair of studs to a bus.

The connectors are flexible and bent to a 45-deg angle so the stud portion can swing away, allowing access to the transformer bushings. The one-piece aluminum top collars are round to fit the buses, have square bottoms to take the bolted-on ferrules of the braids. The connectors are on the outside of the transformer case.

To avoid galvanic action between the aluminum collars and the copper braid ferrules, the ferrules are tin plated. At the other end of the braiding, silver plating on the copper plates gives low resistance.

Now it's Permacel-Le Page

Permacel-Le Page's Inc is the new name of Permacel Tape Corp, New Brunswick, N. J., to reflect the increasing diversity of the product line. Permacel, a Johnson & Johnson company, produces pressure sensitive tapes. Le Page's manufactures adhesive products.



NEW WESTINGHOUSE SELENIUM BATTERY CHARGERS

OFFER LONGEST LIFE, QUIETER OPERATION, NO MAINTENANCE

Whatever your battery-charging requirements, you'll find the economical answer in Selenium Battery Chargers by Westinghouse.

Westinghouse chargers will handle all types of batteries. They are designed for either cyclic or trickle charging operations in a wide variety of applications, including switchgear control, signal, engine starting, communication and powerhouse batteries.

Offering maximum return on your investment, these chargers, built with Westinghouse selenium stacks, made by vacuum process, combine longer life with higher efficiency . . . eliminate wear through the exclusion of all moving parts . . . reduce operating noise level through convection cooling.

For more information about Selenium Battery Chargers for your specific requirements, contact your Westinghouse sales engineer. Or, write to Westinghouse Electric Corporation, P.O. Box 868, 3 Gateway Center, Pittsburgh 30, Pa. Ask for descriptive bulletin 19-200.

J-22068

YOU CAN BE SURE...IF IT'S Westinghouse

PP&L Elects New Chairman and President

CHARLES E. OAKES

JACK K. BUSBY

Charles E. Oakes, president of Pennsylvania Power & Light Co, has been elected chairman of the board. He is succeeded as president by Jack K. Busby, former executive vice president.

Oakes, who remains chief executive officer, has been president since 1945. Since first joining PP&L about 35 years ago, he has also been rate dept engineer, assistant to the president, division manager, and president of Birmingham Electric.

Busby, whose legal background led to the PP&L presidency, joined the utility in 1951 as general counsel. He was made VP-general counsel in 1954. Before joining PP&L he was a member of the law firm of Simpson Thacher & Bartlett.

R. F. KRAUSE

R. E. NOCK

A. V. COLEMAN

E. G. TWOHEY

C. W. JONES

NEES Elevates Five to Key Executive Posts

New England Electric System has announced the election of Robert F. Krause as president of New England Power Co, wholesale subsidiary. In addition, Ralph E. Nock was promoted to vice president of NEES, Alfred V. Coleman to president of New England Power Service Co, Edward G. Twohey to vice president-general manager of Narragansett Electric Co, and Chandler W. Jones to vice president of New England Power.

Krause has been president of NEP Service Co since 1952. A graduate of the University of Arizona and University of Michigan Law School, he joined the corporate department of NEES in 1948. He was named assistant to the president in 1950.

Nock, former VP-general manager of Narragansett Electric, has been identified with utility work since 1912. After holding key posts in electric and transportation companies, in 1946 he was named VP of NEP Service Co and director of personnel administration of NEES and subsidiaries.

Coleman, a vice president of NEES since 1954, has been in the utility field since 1915, when he graduated from Massachusetts Institute of Technology. He has held executive posts in several NEES retail operating companies and became assistant to the president in 1950.

Twohey has had over 30 years experience in utility management. Much of his career has been spent in operating system electric companies in Lawrence, Northampton, and central Massachusetts. Before joining Narragansett in 1956 as VP, he was chief executive of the NEES Gas Division.

Jones is a Worcester Polytechnic Institute graduate with over 25 years' experience in the utility management field. He has been principal officer of NEES companies in western Massachusetts and in 1951 was elected vice president of Narragansett Electric.

D. L. BROUSSARD

T. C. WOODSIDE

P. A. BLANCHARD

Three Get VP Assignments at Utah P&L

The election of D. L. Broussard, T. C. Woodside, and P. A. Blanchard as vice president and the retirement of George R. Corey as executive vice president and secretary has been announced by Utah Power & Light Co.

Broussard, previously assistant to Corey, now becomes VP of financing and secretary. Before joining UP&L in 1950 as engineer, he had been with Texas and Utah highway depts. He was once chief engineer for Lang Co and Utah Crane & Rigging Co.

Woodside retains his duties as treasurer. A 33-year UP&L veteran, he previously held positions as chief clerk and general auditor.

As vice president, Blanchard will be in charge of engineering, construction, and power production. J. A. Hale, who formerly held these responsibilities, continues as VP and general consultant. Blanchard, most recently assistant VP, has also been mechanical engineer, and assistant superintendent of steam plants.

Electrical West Ups Leihy

C. W. Leihy, editor of Electrical West since 1956, has been appointed to the additional post of publisher.

Leihy, who assumes his new duties on Jan. 1, succeeds George C. Tenney. Tenney resigned to devote more time to executive duties in New York, where he is VP and director of McGraw-Hill Publishing Co.

PERSONAL BRIEFS

Robert R. Hart is new Calumet Division supervisor of industrial power sales for Northern Indiana Public Service Co. He succeeds **J. R. Woodfill,** now manager of industrial gas sales.

American Gas & Electric Co has announced that four assistant secretaries of subsidiaries will assume additional posts of assistant treasurer: **W. F. Keehne,** Appalachian Electric Power Co and Kingsport Utilities; **P. T. Cosway,** Ohio Power Co; **C. M. Mortenson,** Indiana & Michigan Electric Co; and **W. B. Garnett,** Kentucky Power Co.

Florida Power Co has named **Samuel G. Whittaker** builder sales supervisor . . . At Baltimore Gas & Electric Co, **Omar K. Boyd** was recently made assistant vice president and **Bernard H. Sherry** became assistant secretary and assistant treasurer.

New general superintendent of the Cleveland steel service plant of Joseph T. Ryerson & Son, Inc, is **Joseph E. Praser.**

Former EW Editor Dies

William H. Onken, Jr, former editor of Electrical World and consulting engineer, died November 29 in his Brooklyn, N. Y., home. His age was 82.

Onken, a noted authority on hydroelectric topics, was editor in chief of EW from 1917 to 1928, when he became senior editor. He later was vice president of National Assn of California and Public Utility Securities, Inc. Onken, who served in this country and abroad as consultant on water power to various public bodies, was chairman of the electrical group at the International Jury of Awards at the 1915 Panama Exposition.

"Letter from Santa"

Dear EW readers:

I will have to skip your presents against this year. Since I'm not giving presents though I do owe you an explanation.

First, I blew my top, hat, and stack over the Atomic Energy program. Seems Uncle Sam has deep pockets and Short Arms when it comes to keeping up with the increased costs of these plants. At the same time I lost my pants in a game called "Pay more for labor; Increase the cost of material; and cut the price of electricity" now being played in some parts of the country.

Boot trouble came when rights-of-way were secured. Let a utility need land and five miles of swamp immediately has a value equal to five blocks of Broadway. I never knew gold, oil, uranium and Rover's bones could exist on a twenty five foot lot. The only people with more problems than the right-of-way department is the Government trying to explain how the Russians came by that flying dog.

Electric heat, to or not to, caused a commotion. Some do, some don't. I'm riding this Genecycle in case the "Don'ters" do. Incidentally, I've gotta start pedaling again. . . . Someone just turned on an air conditioner in Florida and a heater in New York.

All your over loaded under generated buddy can assure you is that Monroe Pope, Dispatcher for FLORIDA POWER & LIGHT COMPANY, does wish you a merry Christmas.

Santa C.

All Electric Booster

To the Editor:

Congratulations on your editorial of October 28th entitled "We Need An All Electric Committee".

Your statement is so true that "all electric" living can be complete only through those whose business is all electric.

Now that electric home heating, properly done, can uniformly excel in ownership results and costs, it is most timely that all electric power suppliers plan for this market.

If our little efforts can add any weight or influence to your all-electric committee or viewpoints, we are ready—so are the customers.

Clement L. Stanford
President
Electriliving Corp
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Questions for McBurney

To the Editor:

In the article in the October 28 issue of *Electrical World* titled "Single Phase Service Costs Less" by Mr. E. M. McBurney of the Kansas City Power and Light Company the author states that a single phase transformer was used with each 3-phase bank for supplying lighting and other single phase load, thus providing separate transformers and secondaries for power and lighting loads.

There are several questions I would like to have answered.

1. Does the Kansas City Power and Light Company require separate meters for power and lighting loads in residential service when both loads are single-phase? When the power is 3-phase and the lighting single-phase?
2. When a lighting transformer is installed with a delta connected 3-phase power bank, are the four transformers installed on the same pole?
3. In the single-phase system, the cost of which is compared with a 3-phase system, are separate transformers and secondaries provided for lighting and power loads?

I would appreciate your getting answers to these questions.

R. C. Hunt
Associate Engineer
Virginia Electric and Power Co
Richmond, Virginia

McBurney Answers:

In regard to the request for answers to the questions concerning my article "Single Phase Service Costs Less", the following is offered.

Answer 1. Kansas City Power & Light Co does not use separate meters in residential service when power and lighting loads are single phase. When the power is 3 phase and lighting single phase, separate meters are required.

Answer 2. In the past, Kansas City Power & Light Co has installed the four transformers on one pole in some instances. However, at present and in the immediate future, for practically all cases, the power bank and lighting transformers will be installed on separate poles. In some very special cases the four transformers may be hung on one pole.

Answer 3. In the comparison between the single phase system and 3 phase system separate transformers were used for power and lighting loads. A five wire secondary system with a common neutral provides separation of the power and lighting loads.

I hope the above answers will help the reader you mentioned in your letter. If he should desire additional details on Kansas City Power & Light Company practices, we would be happy to hear from him. Also available are copies of my original paper "Secondary Design for Modern Residential Load Densities".

E. B. McBurney
Engineering Division
Kansas City Power & Light Co
Kansas City, Missouri

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Electrical Engineer—Municipal Light Plant, located in Greater Boston area, offers an excellent opportunity for graduate electrical engineer, 25 to 30 years of age, with knowledge and experience in the design, construction, maintenance of distribution system, and substation. Preferably, applicant should have five to ten years experience with large electric utility. Position permanent, and demonstrated ability will earn early promotion. Opportunity for further advancement exists. Starting salary will reflect education and experience of appointee. Communications will be received in complete confidence and no inquiries will be made of anyone, other than the applicant, without the prior approval of the applicant. P-6771, Electrical World.

Recently retired Distribution Engineer with field experience. Position open in middle south. P-6667, Electrical World.

Public Utility Rate Man—Excellent opportunity with consulting firm. Prefer age 35-45, college graduate, with electric and/or gas utility experience. State regulatory commission experience would help. Must possess personality and ability to deal with client customers at top management level. Salary depends upon age, experience, previous earnings and capacity. Job requires travel. Send complete resume with photograph to Robb M. Winsborough, Vice President, Middle West Service Company, 20 North Wacker Drive, Chicago 6, Illinois.

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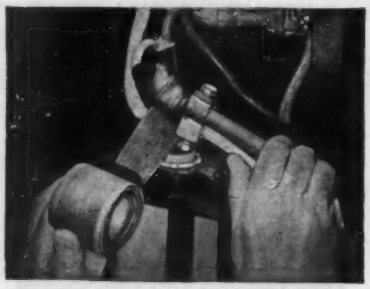

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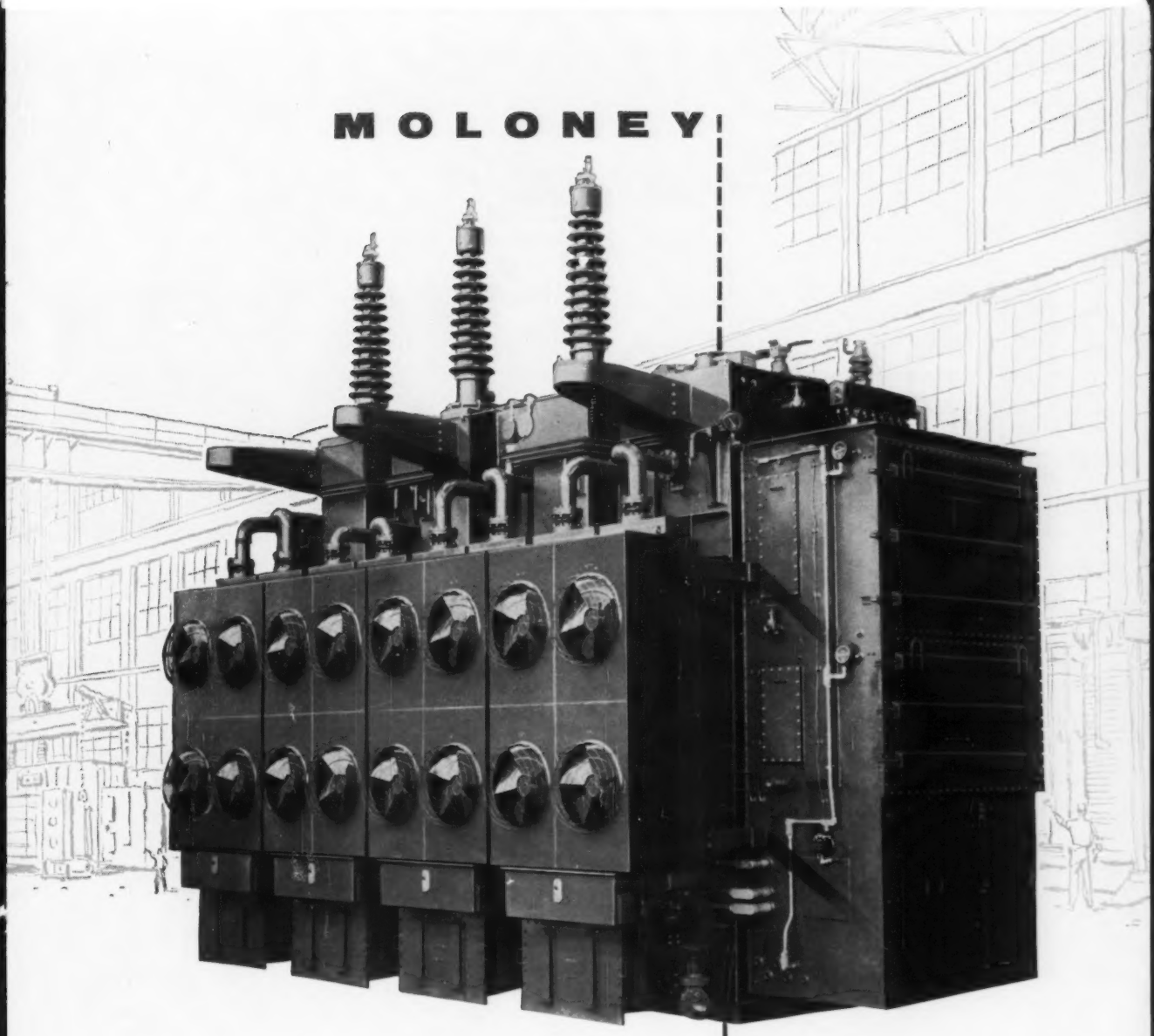

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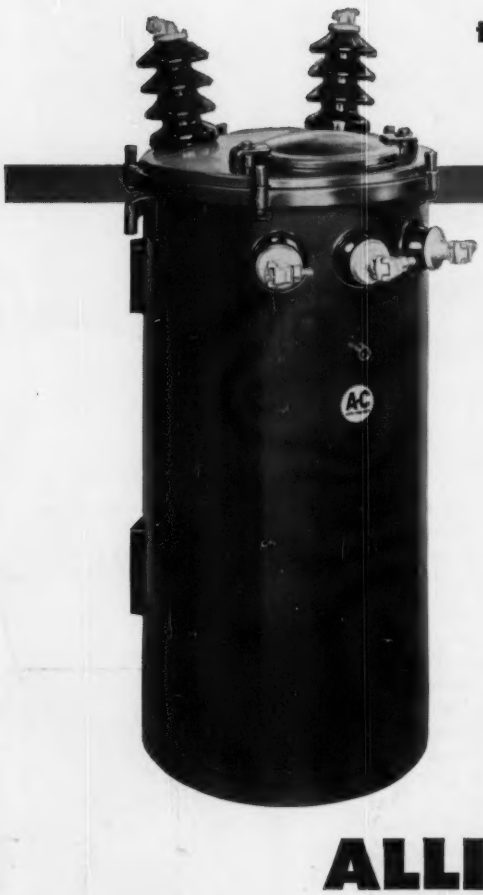

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